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ILLUSTRATIONS

OF THE PRINCIPAL NATURAL ORDERS OF

THE VEGETABLE KINGDOM.

PREPARED FOR THE SCIENCE AND ART DEPARTMENT OF
THE COUNCIL OF EDUCATION.

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PREFACE.

The following descriptions of the principal Natural Orders of Plants were drawn up a few years ago for publication by the Science and Art Department, in the form of large sheets, intended for Museums and Class-room use. I am well satisfied to find that the South Kensington Authorities have determined to issue the plates and accompanying text in this more accessible form. I have revised the letter-press for this edition, correcting several inadvertencies, but adding very little new matter.

D. O.

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I. PHANEROGAMIA.

CLASS 1. DICOTYLEDONS or EXOGENS (*Pages* 1 *to* 110), generally characterised by :-

Leaves irregularly net-veined. Outer whorls of the Flower in 4's or 5's.

Embryo with two Seed-leaves or Cotyledons (hence the term "Dicotyledons" applied to the Class).

Stem, when perennial, with distinct pith, a continuous ring of confluent woody bundles, and a separable bark; increase in diameter taking place by additions outside the wood already formed (hence the term EXOGENS sometimes applied to the Class), and inside the bark.

CLASS 2. MONOCOTYLEDONS or ENDOGENS (*Pages* 111 *to* 137), generally characterised by:—

Leaves straight-veined. Outer whorls of the Flower in 3's.

Embryo with a single Seed-leaf or Cotyledon (hence the term "Monocotyledons" applied to the Class).

Stem, when perennial, without distinct pith, continuous ring of wood or separable bark, the woody bundles permanently closed in diameter after their first formation, and separately and successively embedded in the interior of the stem (hence the term ENDOGENS applied to the Class).

CLASS I. DICOTYLEDONS.

Division i. Polypetalæ (*Pages* 1 *to* 52). Flowers usually with both Calyx and Corolla. Petals distinct (corolla polypetalous).

Division ii. Gamopetalæ (*Pages* 53 *to* 83). Flowers with both Calyx and Corolla. Petals cohering (corolla gamo- or monopetalous).

Division iii. Incompletæ (*Pages* 84 *to* 110). Flowers destitute of Calyx and Corolla (Achlamydeæ), or of Corolla only (Monochlamydeæ).

CLASS II. MONOCOTYLEDONS.

Division i. Petaloideæ (*Pages* 111 *to* 128). Parts of the perianth whorled, usually coloured; rarely wanting.

Division ii. Glumiferæ (*Pages* 129 *to* 137). Flower in the axil of a chaffy scale (glume), or between two scales.

II. CRYPTOGAMIA.

Class 1. ACROGENS (*Pages* 138 *to* 144). Stem and leaf usually distinct; leaves sometimes rudimentary.

Class 2. THALLOGENS (*Pages* 145 *and* 152). No distinction between stem and leaf.

CLASS I. ACROGENS.

Order i. Filices (Ferns). *Page* 138.

Order ii. Equisetaceæ (Horsetails). *Page* 140.

Order iii. Lycopodiaceæ (Clubmosses). *Page* 141.

Order iv. Musci (Mosses). *Page* 143.

CLASS II. THALLOGENS.

Order i. Lichenes (Lichens). *Page* 145.

Order ii. Fungi (Mushrooms, Moulds, etc.) *Page* 146.

Order iii. Algæ (Seaweeds). *Page* 149.

DICOTYLEDONS WITH POLYPETALOUS FLOWERS.

Natural Order

RANUNCULACEÆ. Tab. 1.

DIAGNOSIS.—Herbs with radical or alternate cauline simple leaves, or, in Clematis, woody climbers with opposite usually compound leaves. Stamens hypogynous, indefinite. Pistil apocarpous. Albumen copious.

DISTRIBUTION.—Generally diffused through the Temperate and Arctic zones, both of the Old and New World; rare in hot countries, excepting at high elevations.

NUMBER OF BRITISH GENERA, 10; Species, 28—30.

A large Natural Order, including genera widely different at first sight, owing to considerable diversity in habit and in the envelopes of the flower. Five principal types of structure are distinguished as Tribes, viz. :—

1. CLEMATIDEÆ. Sepals valvate. Fruit a head of achenes. (Leaves opposite).—*Example*, Traveller's Joy (*Clematis Vitalba*).

2. ANEMONEÆ. Sepals imbricate. Ovule solitary, pendulous. Fruit a head of achenes.—*Example*, Wood Anemone (*Anemone nemorosa*).

3. RANUNCULEÆ. Sepals imbricate. Ovule solitary, ascending. Fruit a head of achenes.—*Example*, Buttercup (*Ranunculus bulbosus*).

4. HELLEBOREÆ. Sepals imbricate. Petals tubular or spurred, minute or wanting. Ovules numerous. Fruit usually follicular.—*Examples,* Christmas Rose (*Helleborus niger*), Marsh Marigold (*Caltha palustris*), Larkspur (*Delphinium*).

5. PÆONIEÆ. Sepals imbricate. Petals large and thin. Ovules numerous. Fruit follicular.—*Example,* Garden Pæony (*Pæonia officinalis* and allies).

FLOWERS regular; or irregular in Monkshood (*Aconitum*) and Larkspur; solitary, racemose, or panicled.

SEPALS deciduous; or persistent in Hellebore (*Helleborus*); æstivation imbricate, or valvate in Clematis; often coloured or petal-like; 5 or 4, 10 or more in Globe-flower (*Trollius*), usually 6 in Anemone, 3 in Ranunculus Ficaria; posterior sepal galeate in Monkshood, spurred in Larkspur.

PETALS 5, or more in some species of Ranunculus and Globe-flower; fewer and unequal, the posterior deformed, in Larkspur and Aconite; spurred in Columbine (*Aquilegia*); smaller than the sepals and tubular in Hellebore; linear in Globe-flower; wanting in Clematis, Thalictrum, Anemone, and Marsh Marigold.

STAMENS indefinite; few in Mousetail (*Myosurus*) and in some species of Ranunculus.

CARPELS indefinite; few or definite in Thalictrum, Marsh Marigold, Hellebore, Nigella, Columbine, Aconite, Pæony; solitary in Baneberry (*Actæa*) and Larkspur; connate in Nigella.

OVULES anatropous, solitary or indefinite.

FRUIT various; achenes in Clematis, Thalictrum, Anemone, Adonis, Mousetail, and Ranunculus; follicles in Marsh Marigold, Globe-flower, Hellebore, Columbine, Larkspur, Aconite, Pæony; capsule in Nigella; berry in Baneberry.

USES, &c.—Juices generally acrid; in Monkshood and Baneberry very poisonous. Tramps, to excite compassion, use the leaves of some species of Ranunculus to raise ulcers. Several Ranunculaceæ are or have been used medicinally. Many are ornamental garden-flowers, as species of Clematis, Anemone including the Hepatica (*Anemone Hepatica*), Ranunculus—especially the gay double-flowered oriental *R. asiaticus*, Columbine, Globe-flower, Christmas Rose, *Thalictrum aquilegifolium*, Monkshood, Larkspur, Pæony, Nigella.

Natural Order

BERBERIDACEÆ. Tab. 2.

DIAGNOSIS.– Shrubs with alternate often tufted leaves, or herbs with radical leaves. Stamens hypogynous, definite ; anthers opening by valves. Pistil monocarpellary. Albumen copious.

DISTRIBUTION.—A small Natural Order, most numerous in the North Temperate zone, in the Himalayas, and along the South American Andes.

ONE BRITISH GENUS ; Species, 1.

LEAVES usually compound; unifoliolate, and articulated at the base in Barberry *(Berberis)*, pinnate in Mahonia. The leaves of the barren shoots in Barberry are reduced to trifurcate spines.

FLOWERS regular, usually trimerous, racemose, fascicled or solitary.

SEPALS 6 (8), petal-like, deciduous.

PETALS 6 (4), hooded or spurred in Epimedium.

STAMENS of Barberry irritable when touched at the base of the filament inside ; the anthers of a few exotic genera dehisce longitudinally.

FRUIT usually a berry ; a membranous capsule in Leontice, in some species opening before the seeds are ripe.

USES, &c.—The berries of the Barberry are agreeably acid, and are used as a preserve with sugar ; the wood affords a yellow dye. Several species of Berberis and Mahonia are common in shrubberies, and a few spring-flowering species of the herbaceous genus Epimedium in flower-gardens.

Natural Order

NYMPHÆACEÆ. Tab. 3.

DIAGNOSIS.—Aquatic herbs with round floating leaves and large solitary regular flowers. Petals and stamens indefinite. Carpels indefinite, consolidated, each with a distinct stigma over the cells of the ovary. Albumen mealy.

DISTRIBUTION.—A small Natural Order, widely dispersed in the fresh waters of the Temperate and Tropical zones in both hemispheres.

NUMBER OF BRITISH GENERA, 2; Species, 3.

SEPALS 4—6.

PETALS indefinite, gradually passing into the stamens; in White Water-lily (*Nymphæa*), inserted around the fleshy receptacle in which the carpels are immersed so as to become perigynous or epigynous.

CARPELS in a single whorl; in Sacred Lotus (*Nelumbium*), scattered singly in a free, top-shaped receptacle.

OVULES indefinite, nearly covering the walls of the ovary; definite in Sacred Lotus.

SEEDS with a double albumen in the Water-lilies.

USES, &c.—The seeds of Sacred Lotus are eaten, and the rhizome of this species, as also of some Water-lilies, affords a farinaceous food. The rhizome of White Water-lily is occasionally used as a rustic gray dye.

The South American *Victoria regia*, the largest aquatic plant, with leaves frequently 10—12 feet, and flowers 10—12 inches in diameter, was introduced into England in 1849, and is now frequently grown in warm tanks. Several species of Water-lily (*Nymphæa*), purple, red and white, especially the tropical *N. Lotus*, *N. stellata*, and numerous hybrid forms, also Sacred Lotus (*Nelumbium speciosum*), are in cultivation.

Natural Order

FUMARIACEÆ. Tab. 4.

DIAGNOSIS.—Weak herbs with watery juice and alternate dissected leaves. Inner and outer petals unlike. Stamens hypogynous, definite, usually diadelphous. Ovary one-celled, with one or many parietal ovules. Seeds albuminous.

DISTRIBUTION.—A small Natural Order, chiefly confined to Europe, countries bordering on the Mediterranean and Temperate Asia, with a few at the Cape of Good Hope and in North America. Several species are weeds of cultivated ground everywhere.

NUMBER OF BRITISH GENERA, 2; Species, 3—5.

SEPALS 2, minute, resembling scaly bracteoles.

PETALS 4; posterior outer petal saccate at base in Fumitory (*Fumaria*) and Corydalis; both the outer petals saccate in Dicentra.

STAMENS 6, in two bundles of three each; anther of central stamen of each bundle two-celled, outer anthers one-celled.

OVARY with one ovule in Fumitory, two or more in Corydalis and Dicentra.

FRUIT a one-seeded nut or a capsule.

USES, &c.—None of the Order possess important properties, though a few have been used medicinally. *Dicentra spectabilis*, an ornamental tender Chinese species, and the North American *D. formosa* are frequently cultivated.

Natural Order

PAPAVERACEÆ. Tab. 5.

DIAGNOSIS.—Herbs with yellow or milky juice. Flowers regular, dimerous. Stamens hypogynous, indefinite, free. Pistil syncarpous; placentas parietal. Seeds albuminous.

DISTRIBUTION.—A small Natural Order, chiefly confined to the North Temperate zone. Several of the Poppies *(Papaver)* are wide-spread weeds of cultivation.

NUMBER OF BRITISH GENERA, 5; Species, 8.

LEAVES usually lobed or dissected.

FLOWERS solitary, large, fugacious, on long peduncles.

SEPALS 2, rarely more, falling on expansion of the flower; forming an extinguisher-like cap in Eschscholtzia.

PETALS 4–6, crumpled in bud.

STAMENS perigynous in Eschscholtzia.

OVARY one-celled, the base sheathed by the receptacle in Eschscholtzia; in Poppy (*Papaver*) the placentas often nearly reaching to the centre of the flower, but without cohering.

OVULES in Poppy covering the sides of the infolded carpellary margins.

FRUIT a capsule, dehiscing by pores immediately underneath the apex in Poppy; narrow, elongate, and two-valved in Celandine (*Chelidonium*) and Horned Poppy (*Glaucium*).

USES, &c.—*Papaver somniferum* affords the important narcotic drug Opium, and its derivatives Laudanum and Morphia; it is largely cultivated in the Levant and in India. Opium is the inspissated milky juice collected from gashes made in the unripe fruit. The seeds of Opium Poppy yield a wholesome oil. The orange-coloured juice of Celandine has a popular reputation for the cure of warts. Several of the Poppies, especially double varieties of the common Scarlet Poppy (*Papaver Rhœas*), Opium Poppy, and the large scarlet-flowered *P. orientale* and *P. bracteatum*, also the Californian orange-flowered annual Eschscholtzia and its ally Platystemon, are common in gardens.

Natural Order

CRUCIFERÆ. Tab. 6.

DIAGNOSIS.—Herbs often woody below, with watery juice and alternate exstipulate leaves. Sepals 4. Petals 4. Stamens hypogynous, tetradynamous. Ovary syncarpous with parietal placentation. Seeds exalbuminous.

DISTRIBUTION.—A large Natural Order, abundant in Temperate and Arctic regions, and frequent along the mountain ranges of the Tropics, but by far most numerous in Southern Europe, on the Mediterranean shores, and in the Levant. Wild Mustard and Turnip *(Brassica)* are frequent weeds of waste ground in Europe and Northern Asia. A remarkable genus *(Pringlea)*, allied to Scurvy-grass *(Cochlearia)*, with prostrate stem and cabbage-like tufts of leaves is confined to Kerguelen's Island in the Indian Ocean.

NUMBER OF BRITISH GENERA, 25; Species, 57—60.

FLOWERS regular, or occasionally irregular, owing to the centrifugal enlargement of the outer (anterior) petals, as in Candytuft (*Iberis*); white, yellow, red, or purple; almost invariably in terminal racemes; in *Senebiera didyma* the racemes are lateral or leaf-opposed, owing to their becoming overtopped by axillary shoots, which apparently continue the axis; rarely bracteate.

SEPALS free, deciduous.

PETALS cruciate, clawed or narrowed to the base; pinnatifid in the garden annual *Schizopetalum*.

STAMENS 6, 2 lateral ones usually shorter; indefinite in the Himalayan *Megacarpæa polyandra;* fewer than 6 in Cress (*Lepidium*) and Senebiera.

OVARY usually 2-celled owing to the development of a vertical cellular partition from the two opposite placentas.

FRUIT, various; one—many-seeded; usually a capsule dehiscing by two valves which separate from a persistent sutural frame; capsule much longer than broad, as in Wall-flower (*Cheiranthus*) and Watercress (*Nasturtium*), or as broad, or nearly as broad as long in Shepherd's Purse (*Capsella*) and Honesty (*Lunaria*); indehiscent, several-seeded and transversely jointed in Radish (*Raphanus*); indehiscent and 1-seeded in Woad (*Isatis*) and Sea-Kale (*Crambe*); indehiscent and 2-seeded, separating in two nuts, in Senebiera; dissepiment of fruit across the broader diameter of the fruit in Honesty, across the narrow diameter in Shepherd's Purse.

EMBRYO usually with the radicle folded over the cotyledons, either over the edge of the cotyledons as in Wall-flower, or over the back as in Hedge Mustard (*Sisymbrium*); the cotyledons folded (conduplicate) or plane, 3-lobed in Garden Cress (*Lepidium sativum*).

USES, &c.—Although many of the Cruciferæ possess considerable acridity, none of them are poisonous, and a large number under cultivation are valuable as food-plants, or as affording condiments. The Order generally is stimulant and antiscorbutic, often abounding in a sulphurous ethereal oil. Of the species in household use are the innumerable varieties of Cabbage (*Brassica oleracea*), including Cauliflower Broccoli and Brussels Sprouts, Mustard (*Sinapis*) Garden Cress (*Lepidium sativum*), Watercress (*Nasturtium officinale*), Radish (*Raphanus sativus*), Turnip (*Brassica Napus*), Horse-radish (*Cochlearia Armoracia*) and Sea-kale (*Crambe maritima*). A valuable oil is expressed from the seeds of the Colza, a variety of the Turnip. The blue dye Woad used to be obtained from *Isatis tinctoria.*

Common ornamental hardy garden plants belonging to Cruciferæ are Wallflower, Stock (*Matthiola*), Alpine Rock Cress (*Arabis alpina*), Alyssum, the Orange-Flowered Erysimum (*E. Peroffskianum*), Candytuft, and several others.

Nearly allied to Cruciferæ is the exotic Order CAPPARIDACEÆ, differing in the stamens, which are not tetradynamous and often more numerous, as well as frequently presenting the anomaly of a stalked ovary. The Caper-bush (*Capparis spinosa*), the buds of which are pickled as "Capers," is a South European member of the Order.

Natural Order

RESEDACEÆ. Tab. 7.

DIAGNOSIS.—Herbs with alternate often tufted leaves. Petals usually palmately divided. Stamens inserted upon a one-sided hypogynous disk. Pistil syncarpous, with parietal placentation. Seeds exalbuminous.

DISTRIBUTION.—A small Order principally confined to countries bordering the Mediterranean, with several species throughout Central Europe, and a few extending eastward to India.

ONE BRITISH GENUS; Species, 2.

FLOWERS racemose, usually irregular; bracteate.

SEPALS 4 to 8.

PETALS 4 to 8; in Mignonette (*Reseda*) unequal, with a broad claw and multifid limb.

STAMENS indefinite; often few.

FRUIT opening at the apex before the seeds are ripe in Mignonette.

USES, &c.—None of the Order are of much economic importance. Weld or Dyer's Mignonette (*Reseda Luteola*) is used as a yellow dye. Sweet Mignonette is a universal garden favourite; it has not been satisfactorily recognised in the wild state, though some very near allies are indigenous in the Levant.

Natural Order

CISTINEÆ. Tab. 8.

DIAGNOSIS.—Annuals, wiry perennials or shrubs. Sepals 5, two outer usually smaller. Corolla regular; petals 5, early falling. Stamens hypogynous, indefinite. Ovary syncarpous, partially or wholly 3–5-celled. Seeds indefinite, albuminous.

DISTRIBUTION.—A small Order, by far most numerous in species in South Europe and countries bordering on the Mediterranean, where the prevalence of Cistineæ gives character to the vegetation. A few are North American.

ONE BRITISH GENUS; Species, 4.

LEAVES usually opposite, with or without stipules.

FLOWERS in terminal racemose cymes, or solitary.

SEPALS 5; the two outer much smaller, regarded by some as bracts, by others as analogous to stipules.

PETALS sessile, broad, thin, and fugacious; yellow, white or red, never blue.

STAMENS of Rock-rose (*Helianthemum*) slightly irritable on the application of mechanical stimulus to the receptacle.

PLACENTAS—3 in Rock-rose, 5 in Cistus.

USES, &c.—Cistineæ are destitute of any marked properties, and none are of economic importance. A few are balsamic, and a resin used formerly to be collected from *Cistus creticus* and its allies, which was a reputed remedy for the plague.

Several species of Rock-rose and numerous garden varieties and hybrids are common in cultivation and well suited for rockwork and dry borders. Gum Cistus (*Cistus ladaniferus*) is an old favourite in the shrubbery.

Natural Order

VIOLACEÆ. Tab. 9.

DIAGNOSIS.—Herbs (or shrubs or trees in extra-European genera) with alternate stipulate leaves. Stamens hypogynous, definite: anthers with the connective projecting at the apex. Ovary 1-celled, with 3 parietal placentas. Seeds albuminous.

DISTRIBUTION.—Excepting the large herbaceous genus Violet (*Viola*), which is generally diffused throughout temperate regions and cooler parts of the Torrid zone, Violaceæ are principally tropical, about one-half of the genera being peculiar to the tropics of the New World. The arborescent species are all extra-European.

ONE BRITISH GENUS; Species, 5.

FLOWERS axillary, solitary or cymose.

SEPALS 5; in Violet nearly equal, projecting at the base.

PETALS 5; in Violet the lower one broader and spurred at the base.

STAMENS 5; the connective always produced above, and the two lower ones each with a tail-like appendix projecting into the spur of the lower petal.

FRUIT usually opening in three valves, each bearing a placenta upon the middle. In Sweet Violet (*Viola odorata*) and its allies, the ordinary spring flowers do not generally ripen seed; later in the season minute hermetically closed flowers, usually concealed amongst the withered leaves, which never expand and which are self-fertilised, develope seed in abundance.

USES, &c.—The root of many of the Violaceæ possesses emetic or purgative properties, and on this account they have been employed in medicine. Garden Pansies, so various in the coloured marking of their petals, are derived from *Viola tricolor* and *V. altaica*. Two long-spurred species, *V. calcarata* and *V. cornuta*, also the Yellow Pansy (*V. lutea*), are useful ornamental border plants, and the Sweet Violet (*V. odorata*) is a universal favourite.

Natural Order

POLYGALACEÆ. Tab. 10.

DIAGNOSIS.—Herbs, often wiry, or undershrubs, with alternate simple leaves. Flowers irregular. Stamens hypogynous, 8 or rarely fewer, monadelphous. Pistil syncarpous. Ovary 2-celled, with one ovule in each cell.

DISTRIBUTION.—Widely dispersed through the temperate and warmer regions of the Globe. The cosmopolitan and only European genus, Milkwort (*Polygala*), includes about half of the Natural Order. The Rhatanys (*Krameria*) of South America closely connect the Order with Leguminosæ.

ONE BRITISH GENUS; Species, 3.

FLOWERS usually racemose in Milkwort.

SEPALS 5, distinct, unequal; two inner much larger, petal-like, often persistent, called wings (*alæ*).

PETALS in Milkwort 3; the central one concave or hooded, called the keel (*carina*), often crested at the apex; each singly adnate below to the open sheath of stamens; two posterior petals usually suppressed.

ANTHERS 1-celled by obliteration of the connective of an originally 2-celled anther, and dehiscing by a pore in Milkwort.

FRUIT usually a compressed 2-seeded capsule.

USES, &c.—Polygalaceæ are generally characterised by bitterness and acridity. Several species of the genus Milkwort are employed in medicine. The astringent Rhatany-root is derived from a South American *Krameria*. One or two beautiful species of Milkwort from the Cape of Good Hope are commonly cultivated in greenhouses.

Natural Order

CARYOPHYLLACEÆ. Tab. 11.

DIAGNOSIS.—Herbs with opposite entire exstipulate leaves. Stamens hypogynous, definite. Pistil syncarpous. Ovary 1-celled, with a free central placenta. Seeds with mealy albumen.

DISTRIBUTION.—A rather large Natural Order, of which the greater proportion is principally confined to the North Temperate zone, where some of the genera are widely spread, while others are nearly peculiar to South Europe and the Levant. A few, as Chickweed (*Stellaria media*), are weeds accompanying man in his migrations. A few genera affect Arctic and Alpine situations.

NUMBER OF BRITISH GENERA, 13; Species, 56.

FLOWERS regular, terminal, solitary or cymose.

SEPALS usually 5; united in Pink (*Dianthus*), Campion (*Lychnis*), Catchfly (*Silene*), and others: distinct in Stitchwort, Chickweed (*Stellaria*), Mouse-ear Chickweed (*Cerastium*), and others. Upon this distinction depend the two principal Tribes of the Natural Order.

PETALS 5, clawed or sessile; entire, bifid, or fimbriate; rarely minute or wanting.

STAMENS usually twice as many as petals.

OVARY 1-celled, but traces of as many arrested partitions as styles (2—5) are often visible at the base of the cavity; frequently raised upon a short stalk (*gynophore*).

FRUIT a capsule, dehiscing by teeth or valves.

EMBRYO usually curved, often surrounding the albumen.

USES, &c.—The Order is destitute of any marked properties, and very few species are turned to economic account. The root of a few possesses a saponaceous principle. Many of the Caryophyllaceæ are familiar garden flowers, as the numerous varieties of Pink, Carnation, and Sweet William (*Dianthus*); the Campions (*Lychnis chalcedonica, L. Coronaria*, and allies), and the Catchflys (*Silene*), of which several species are cultivated.

Natural Order

FRANKENIACEÆ. Tab. 12.

DIAGNOSIS.—Herbs or low shrubs, with the general characters of Caryophyllaceæ, differing in having parietal placentation.

DISTRIBUTION.—A very small monotypic Natural Order affecting maritime stations, widely dispersed over the warmer and temperate zones.

ONE BRITISH GENUS; Species, 1.

SEPALS 5–4, united into a tubular calyx.

PETALS as many as calyx-teeth, clawed, with a longitudinal membranous appendix on the inner face of the claw.

USES, &c.—None are of economic value. The leaves of a remarkable species (*Frankenia Beatsonia*), peculiar to St. Helena, resembling a miniature tree, are said to have been used as tea. Some of the low pink-flowered cushion-like species are suited for rockwork culture.

PORTULACEÆ is a small Natural Order nearly related to Caryophyllaceæ, differing in succulent habit, and in having a calyx usually consisting of but two sepals. It is represented in Britain by a single inconspicuous species, the Blinks or Water Chickweed (*Montia fontana*), a plant, like many other aquatics, with a remarkably wide geographical distribution, occurring in watery places in every quarter of the Globe.

The genus Purslane (*Portulaca*) is exceptional in the Order in having the ovary partially immersed in the receptacle so that the petals and stamens become perigynous. Several exotic species of Purslane and *Calandrinia*, with gay but fugacious flowers, are frequent in gardens.

Natural Order

HYPERICINEÆ. Tab. 13.

DIAGNOSIS.—Herbs or shrubs with opposite leaves. Flowers regular. Stamens hypogynous, indefinite. Pistil syncarpous. Ovary wholly or partially 3–5-celled. Seeds exalbuminous.

DISTRIBUTION.—A small Natural Order, generally diffused throughout the Temperate and Tropical zones. St. John's Wort (*Hypericum*), the only genus represented in Europe, includes considerably more than one-half of the Order.

ONE BRITISH GENUS; Species, 9.

LEAVES frequently dotted with translucent glands.
FLOWERS yellow, regular, usually in terminal cymes.
SEPALS 5–4, distinct, frequently bordered, as are the Petals, with minute black glands.
PETALS 5–4, imbricate, often oblique.
STAMENS more or less distinctly united below in 3 or 5 bundles.
FRUIT a capsule.

USES, &c.—None of the Order possess much economic importance. Several are resinous, and a few American species have been used in medicine. Shrubby species of St. John's Wort from South Europe and the Atlantic Islands are frequently grown in shrubberies.

Natural Order

TERNSTRŒMIACEÆ. Tab. 14.

DIAGNOSIS.—An extra-European ligneous Natural Order nearly allied to

Hypericineæ; differing in having usually alternate leaves and axillary flowers, as well as in some variable floral characters.

DISTRIBUTION.—Dispersed throughout the Tropics of both Hemispheres, with several species extending into the North Temperate zone, especially in Eastern Asia and Japan, where they form an important element in the woody evergreen vegetation.

FLOWERS regular, often showy.

PETALS frequently connate below.

STAMENS indefinite, free or monadelphous, and then adherent to the base of the petals.

PISTIL syncarpous; ovary with axile placentation.

USES, &c.—Almost the only member of the Natural Order prominent on economic grounds is the Tea-shrub (*Thea chinensis*), a native probably of the mountainous tract extending from the Eastern Himalaya to China. Notwithstanding its cultivation from time immemorial in China, Tea has not been observed in a wild state in that country: it occurs native, however, in the jungles of Assam in North-Eastern India. Tea, of which upwards of one hundred millions of pounds are imported annually, consists of the dried leaves prepared by peculiar methods; rapidly for Green and more slowly for Black Tea. The principal source of supply is China, but Japan and Northern India, into the latter of which the Chinese cultivated varieties have been introduced, contribute a portion. Closely allied to Tea is the Garden Camellia (*Camellia japonica*), long introduced from Japan into European greenhouses, of which it is a chief winter ornament. The Souari-nut of South America is the produce of a genus (*Caryocar*) allied to Ternstrœmiaceæ, but differing in having compound digitate leaves.

GUTTIFERÆ is another exotic Order, exclusively tropical, allied to Hypericineæ and Ternstrœmiaceæ, with opposite leaves as in the former; differing in having usually unisexual flowers and other floral characters. It is chiefly remarkable as including the Gamboge tree (*Garcinia Morella*) of India, and several valued tropical fruits; amongst the rest, the Mangosteen (*Garcinia Mangostana*) of Malacca, and the West Indian Mammee Apple (*Mammea americana*). The Order is generally characterised by the prevalence of a coloured purgative resinous juice, readily exuding when the bark is cut, as Gamboge.

Natural Order

MALVACEÆ. Tab. 14.

DIAGNOSIS. — Herbs shrubs or trees, with alternate stipulate leaves. Flowers regular. Sepals 5, connate below; valvate in bud. Stamens hypogynous, indefinite, monadelphous; anthers 1-celled. Pistil syncarpous.

DISTRIBUTION.—A considerable Natural Order, generally dispersed throughout the warmer regions of the Globe: absent from the Arctic zone. The Baobab *(Adansonia)*, the most gigantic member of the Order, the trunk attaining a diameter of 30 feet, though not proportionally tall, occurs in Equatorial Africa and in India.

NUMBER OF BRITISH GENERA, 3; Species, 5.

FLOWERS usually axillary, in fascicles or solitary.

CALYX often furnished with an involucre of three or more bracts, as Mallow *(Malva)* with three bracts, Hibiscus usually with numerous bracts.

PETALS 5, inserted upon the base of the staminal tube; twisted-imbricate in bud.

POLLEN in Mallow large, globose, muricate.

CARPELS usually arranged in a single whorl, connate, the ovary 5- or many-celled; in *Malope* capitate.

SEEDS with or without albumen.

USES, &c.—The Malvaceæ are generally mucilaginous, destitute of hurtful properties, and characterised by a tenacious liber, often used for rough cordage. Cotton consists of the long hairs investing the seeds of a few species of Gossypium, cultivated throughout tropical and sub-tropical regions.

Hollyhock (*Althæa rosea*), Lavatera, Mallows, and several greenhouse and stove plants belonging to the genera Hibiscus and Abutilon, are generally cultivated for ornament.

Natural Order

TILIACEÆ. Tab. 15.

DIAGNOSIS.—Trees or shrubs, rarely herbs, with alternate stipulate leaves. Flowers regular. Sepals distinct, valvate in bud. Stamens hypogynous, indefinite, distinct or nearly so; anthers 2-celled. Pistil syncarpous.

DISTRIBUTION.—Extra-European, with the exception of the genus Lime (*Tilia*): chiefly tropical.

ONE BRITISH GENUS; Species, 1.

LEAVES more or less oblique at the base in Lime.

FLOWERS of Lime in axillary pedunculate cymes; the peduncle adnate half its length to the narrow bract.

PETALS imbricate in bud, free.

USES, &c.—Like Malvaceæ in their copious mucilage and tenacious liber. The bark of tropical species of Corchorus is imported as jute. The Common Lime (*Tilia europæa*) affords the Russia-matting of Northern Europe. The wood is close-grained, soft, and well-suited for carving. It is used in the construction of the frames of stringed musical instruments, for which its freedom from warping fits it.

STERCULIACEÆ, an extra-European Natural Order allied to Malvaceæ, from which it differs in the stamens being frequently definite and the anthers 2-celled, includes the Cocoa-tree (*Theobroma Cacao*), cultivated in Tropical America and in Trinidad. The seeds roasted and variously prepared constitute cocoa and chocolate.

Natural Order

LINACEÆ. Tab. 16.

DIAGNOSIS.—Usually herbs (or shrubs), with alternate exstipulate leaves. Flowers regular. Sepals and petals each 5, distinct. Stamens hypogynous, definite. Ovary 3-5-celled. Fruit separating into cocci, without a central axis.

DISTRIBUTION.—A small Natural Order widely dispersed throughout the Temperate and Tropical zones in both hemispheres. More than half of the species belong to the genus Flax (*Linum*), which is chiefly temperate and subtropical in distribution.

NUMBER OF BRITISH GENERA, 2; Species. 4.

LEAVES opposite in Allseed (*Radiola*).

SEPALS 4; 3-lobed, united below, and PETALS 4 in Allseed.

STAMENS usually shortly monadelphous; in Flax, with alternating staminodes.

OVARY spuriously 10-celled in Flax, owing to the inflection of the dorsal suture of each carpel.

USES, &c.—Characterised by a tenacious liber, for the sake of which (as linen) Flax (*Linum usitatissimum*) is largely cultivated in Northern Europe. The seeds (Linseed) of the same species afford a valuable oil, and the coat of the seed abounds in mucilage. The refuse of the seeds is compressed into "oil-cake," used to feed cattle. Several species of Flax with blue yellow or crimson, but fugacious flowers, are frequent border-plants in our gardens.

Natural Order

OXALIDACEÆ. Tab. 17.

DIAGNOSIS.—Herbs (or exotic shrubs) with radical or alternate cauline trifoliolate or pinnate leaves. Flowers regular. Sepals and petals each 5. Stamens hypogynous, definite. Ovary 3-5-celled. Fruit usually capsular, with a persistent central, but not prolonged, axis.

DISTRIBUTION.—A small Order, excepting a few species in the North Temperate zone and dispersed through the Tropics, chiefly confined to South America and the Cape of Good Hope. The only indigenous British species is distributed almost throughout the North Temperate zone.

ONE BRITISH GENUS; Species 1 (and one or two introduced weeds).

LEAVES in some species of Sorrel (*Oxalis*) sensitive to mechanical irritants.

FLOWERS in Wood-sorrel (*O. Acetosella*) dimorphous; the conspicuous petal-bearing flowers developed in spring are succeeded by minute hermetically closed flowers concealed around the root. Both kinds of flower perfect seed.

SEEDS albuminous, with an outer elastic fleshy coat, which bursts when mature.

USES, &c.—The leaves are generally sour, owing to the presence of oxalic acid. Two tropical arborescent species of Averrhoa afford succulent edible fruits, the Blimbing and Carambola; and the tubers of a few species of Oxalis are esculent. Several species of Sorrel are grown in flower-gardens.

Natural Order

GERANIACEÆ. Tab. 18.

DIAGNOSIS.—Herbs with alternate or opposite simple stipulate leaves. Stamens hypogynous, 10 or fewer. Ovary 5-lobed, 5-celled. Fruit separating into cocci from an elongate persistent axis.

DISTRIBUTION.—A small Natural Order, most numerous in temperate regions. Of the three principal genera, Crane's-bill *(Geranium)* is widely dispersed, Pelargonium almost exclusively confined to the Cape of Good Hope, and Stork's-bill *(Erodium)* concentrated around the Mediterranean.

NUMBER OF BRITISH GENERA, 2; Species, 14.

FLOWERS regular, or irregular in Pelargonium.

SEPALS 5, distinct or nearly so, imbricate; the posterior sepal spurred in Pelargonium, the spur adnate throughout to the pedicel.

PETALS 5, twisted-imbricate, equal or unequal in Pelargonium.

STAMENS 10 in Crane's-bill, 3 or more imperfect in Pelargonium, 5 in Stork's-bill; free or shortly monadelphous.

FRUIT, cocci with long elastic tips curling upwards from a persistent axis.

SEEDS with or without albumen; cotyledons often folded.

USES, &c.—None of the species are of much economic importance. Several species of Cape Pelargonium, especially varieties and hybrids derived from *Pelargonium inquinans*, *P. cucullatum*, *P. zonale* and others, in conservatories, and the "Scarlet Geraniums" of our borders, take a foremost rank amongst ornamental flowers. A few perennial European species of Crane's-bill are also in cultivation.

Natural Order

TROPÆOLACEÆ.

DIAGNOSIS.—Twining or diffuse juicy herbs with alternate palmately-veined leaves. Flowers irregular, spurred. Stamens hypogynous, 8. Ovary 3-lobed, 3-celled. Fruit separating into cocci from a short persistent axis.

DISTRIBUTION.—A very small Natural Order (by many Botanists regarded as a tribe of Geraniaceæ), confined to South America; chiefly to Chili, Peru, and Equador.

SEPALS 5, united below, posterior sepal spurred, spur free.

SEEDS one in each cell, exalbuminous.

USES, &c.—Characterised by a pungent juice and antiscorbutic properties. The unripe fruit of the ornamental Indian Cress or Garden Nasturtium (*Tropæolum majus*) is pickled and used as capers. A second species, the Canary Flower (*T. peregrinum*), is a common half-hardy ornamental climber, and a few others with red, blue, or parti-coloured flowers are cultivated in plant-houses.

Natural Order

BALSAMINEÆ.

DIAGNOSIS.—Herbs with succulent stems and alternate or opposite leaves. Flowers irregular, spurred or saccate. Stamens hypogynous, 5. Ovary 5-celled. Fruit a capsule.

DISTRIBUTION.—Another small Natural Order allied to the two preceding, and scarcely ordinally distinct. But one species is European, two are American, and the rest are restricted to Tropical and Southern Africa and Asia, being most numerous in India.

ONE BRITISH GENUS; Species, 1 (and one or two introduced and naturalized).

SEPALS 3 or 5, the posterior sepal spurred or saccate.
PETALS 5, the lateral and posterior usually united, and thus apparently only 3.
STAMENS with the anthers connivent or connate around the stigma.
FRUIT dehiscing by 5 elastic valves, separating from below upwards.

USES, &c.—Without economic importance. One Indian species, the Garden Balsam (*Impatiens Balsamina*), is a favourite tender annual, of which an infinite number of double variously-coloured varieties have originated under cultivation. The only species indigenous in Europe, the Touch-me-Not (*Impatiens Noli-me-tangere*), takes its name from the irritability of the ripe fruit, which bursts with the slightest stimulus.

Natural Order

RUTACEÆ. Tab. 19.

DIAGNOSIS.—Herbs shrubs or trees, with alternate or opposite translucently-dotted leaves. Flowers regular. Sepals and petals 4-5. Stamens hypogynous; as many, or twice as many as petals. Pistil syncarpous, with axile placentation.

DISTRIBUTION.—A large exotic Natural Order, chiefly confined to the warmer regions of the Globe. One tribe (*Diosmeæ*) is confined to the Cape of Good Hope, another (*Boroneæ*) to Australia, and a third (*Aurantieæ*) to Tropical and Eastern Asia, the remainder being generally dispersed throughout the Tropics and warmer countries of the Temperate zones.

LEAVES usually compound in Zanthoxyleæ and Aurantieæ. In Orange (*Citrus Aurantium*) and its allies reduced to a single leaflet, the blade of which is articulated at the base to a winged petiole; almost invariably dotted with translucent glands containing a volatile oil.

STAMENS free, or in Orange polyadelphous.

OVARY lobed as in Rue (*Ruta*), the lobes ultimately separating as cocci, or entire as in Orange.

SEEDS with or without albumen; in Orange exalbuminous, and usually containing two or more embryos, distorted from mutual pressure.

USES, &c.—The species of principal economic value belong to the genus Citrus, which includes the Orange (*C. Aurantium*), Lemon (*C. Limonum*), Citron (*C. medica*), Lime (*C. Limetta*), the Mandarin or Tangerine Oranges (*C. nobilis*), and their allies. The origin of these forms, which have been cultivated from a remote period throughout the Tropics, is obscure. They have probably all been derived from one or two species native in Tropical Asia or the Indian Archipelago. The oranges imported into Britain are chiefly grown in the Island of St. Michael's in the Azores, and in the south of Europe. The small fruits of a Chinese and Japanese Citrus are imported as a confection in sugar. The fruit of the Wampee (*Cookia punctata*) is similarly prepared in India and China. Oil of Neroli and Bergamot are distilled from the flowers and rind of the fruit of a Citrus. The dry-fruited Rutaceæ are generally aromatic and pungent; many of them are employed in their respective countries medicinally, and the seeds of a few species as a condiment; the Cape Diosmeæ more particularly are often strongly and disagreeably scented. American species of the Tribe Cusparieæ contain a bitter alkaloid employed, as in Angostura bark (*Galipea*), as a febrifuge.

Numerous Australian and Cape species are cultivated in greenhouses, more especially of the genera *Boronia*, *Correa*, *Eristemon*, and *Barosma*; also in our stoves, the Tropical American genus *Erythrochiton*. Common Rue (*Ruta graveolens*), a rustic medicine formerly used as a prophylactic against plague, and Fraxinella (*Dictamnus*) are in every garden.

Nearly allied to Rutaceæ is the tropical Natural Order SIMARUBEÆ, which differs in having eglandular leaves, and the stamens frequently provided with an adherent scale. The species are almost invariably characterised by extreme bitterness, as the Bitterwoods, used as popular tonic medicines, derived from Tropical American species of *Picræna* and *Quassia*.

Natural Order

ILICINEÆ. Tab. 20.

DIAGNOSIS.—Evergreen shrubs or trees, with glabrous eglandular, often coriaceous, alternate leaves. Flowers small, regular. Petals 4-5, free or connate below. Stamens 4-5, hypogynous or epipetalous. Pistil syncarpous, with axile placentation.

DISTRIBUTION.—A small Natural Order, widely dispersed in temperate and tropical countries; most numerous in South America, and represented by but a single species in Tropical Africa and in Australia respectively. Common Holly (*Ilex Aquifolium*), the only British member of the Order, extends across Western and Southern Europe to the Black Sea.

ONE BRITISH GENUS; Species, 1.

FLOWERS subdiœcious in Common Holly.

FRUIT a drupe, with 4 bony 1-seeded pyrenes.

USES, &c.—The white close-grained wood of Common Holly is in request for Marquetry ware, and from the bark bird-lime is prepared. The leaves of a South American Holly (*Ilex paraguayensis*) are dried as Maté or Paraguay tea. Common Holly, in various varieties, is in every shrubbery, and a few allied species from Madeira, the Mediterranean, the Himalaya and Japan, are in cultivation.

Natural Order

CELASTRINEÆ. Tab. 26.

DIAGNOSIS.—Shrubs or trees with opposite or alternate leaves. Flowers small, regular. Stamens perigynous, alternate with the petals, inserted into or around a fleshy disk. Ovary free or immersed in the disk, 3-5-celled.

DISTRIBUTION.—A considerable Natural Order, generally diffused through tropical and subtropical regions. The only British species extends eastward to Western Asia.

ONE BRITISH GENUS; Species, 1.

CALYX small, with 4-5 overlapping lobes.

PETALS and STAMENS as many as calyx-lobes.

DISK various; in Spindle-tree (*Euonymus europæus*) conical and confluent with the ovary.

FRUIT in Spindle-tree a crimson capsule, dehiscing loculicidally.

SEEDS albuminous; in Spindle-tree enclosed in an orange-coloured aril.

USES, &c.—The Order is not of economic importance. Charcoal suited for drawing is prepared from the wood of Spindle-tree. *Catha edulis*, an Abyssinian and Arabian species, is regarded as an antidote to plague, and the leaves are chewed as a stimulant. A few species are cultivated in shrubberies.

Natural Order

RHAMNACEÆ. Tab. 22.

DIAGNOSIS.—Shrubs or trees, usually with alternate leaves. Flowers small, regular. Stamens perigynous, definite, opposite to the petals. Ovary free or immersed in the disk, 3-4-celled.

DISTRIBUTION.—Chiefly tropical or sub-tropical, with a few outlying genera both in the North and South Temperate zones. A few peculiar almost leafless genera are confined to Western and Extra-tropical South America.

ONE BRITISH GENUS; Species 2.

CALYX small, with 4-5 short teeth.

PETALS and STAMENS as many as calyx-lobes, or petals wanting; the stamens always alternate with the calyx-lobes.

DISK various, lining the calyx-tube in Buckthorn (*Rhamnus*).

FRUIT various; drupaceous with 2-4 one-seeded pyrenes in Buckthorn.

SEEDS albuminous.

USES, &c.—The fruit of Common Buckthorn (*R. catharticus*) and allied species affords a yellow and green dye, and is the source from which the pigment "sap-green" is prepared. Jujubes are the edible drupes of species of *Zizyphus* cultivated in South Europe and the East. In Eastern Asia the fleshy peduncles of *Hovenia dulcis* are an esteemed dessert. The charcoal principally used in England in the manufacture of gunpowder is prepared from the fine-grained wood of Alder Buckthorn (*Rhamnus Frangula*). Several species of the North American genus *Ceanothus* and the South European Alaternus (*Rhamnus Alaternus*) are frequent in shrubberies.

Natural Order

AMPELIDEÆ. Tab. 23.

DIAGNOSIS.—Climbing shrubs with jointed stems, alternate leaves and leaf-opposed tendrils. Flowers minute. Petals 4-5, valvate in bud, falling on expansion. Stamens opposite to the petals. Ovary surrounded by a disk; placentation axile.

DISTRIBUTION.—Chiefly tropical and sub-tropical in both hemispheres. None indigenous in Europe.

INFLORESCENCE leaf-opposed and theoretically terminating the internode immediately below; frequently reduced to a flowerless prehensile peduncle (*tendril*).

CALYX in Grape Vine (*Vitis vinifera*) minute, cup-shaped, entire.

PETALS in Grape Vine cohering by their tips, thrown off on expansion.

FRUIT baccate, superior.

SEED albuminous.

USES, &c.—Almost the only species turned to account by mankind is the Grape Vine, from remote antiquity extensively cultivated in South Europe and the Levant, and now very widely dispersed, though, for fruit-bearing purposes, under rather restricted climatal conditions. From the innumerable varieties of this shrub we have, besides grapes yielding the wines of commerce, other sorts which are dried, as "Valentia," "Malaga," and "Sultana" (seedless) raisins. Dried currants are derived from a small-fruited variety cultivated in countries around the Eastern Mediterranean. A Tropical Indian species of Vine (*V. discolor*) is commonly cultivated in stoves for the sake of its beautifully-coloured foliage, the leaves being silver-blotched above from the presence of a film of air under the epidermis, and crimson beneath. The North American "Virginian Creeper" (*Ampelopsis quinquefolia*) is one of our commonest ornamental hardy climbers.

Natural Order

ACERINEÆ. Tab. 24.

DIAGNOSIS.—Trees with opposite simple (rarely pinnate) leaves. Flowers regular. Stamens as many as or more than the petals, inserted in an annular hypogynous disk. Ovary free, usually 2-celled.

DISTRIBUTION.—A small Natural Order allied to the exotic Order Sapindaceæ; nearly confined to the North Temperate zone, though common to both the Old and New World. Sycamore (*Acer pseudo-platanus*), everywhere planted, and often self-sown in Britain, is indigenous in Central Europe and Western Asia.

ONE BRITISH GENUS; Species, 1 (and one introduced and naturalized).

FLOWERS greenish, in simple or compound racemes, often unisexual from abortion.

STAMENS about 8, the calyx and corolla usually pentamerous.

FRUIT separating into two indehiscent winged nuts.

SEED exalbuminous; embryo with thin plaited cotyledons.

USES, &c.—The wood of Sycamore (*Acer pseudo-platanus*) is white, soft, easily worked, and adapted for bowls, platters, and other turnery. Bird's-eye Maple and Curly or Mottled Maple afforded by old or gnarled trees of *Acer saccharinum* and *A. rubrum* are valuable and very ornamental cabinet woods. Other North American species afford useful timber. From the North American Sugar Maple (*Acer saccharinum*) Maple-sugar is prepared by boiling down and clarifying the sap collected by tapping the trunk in spring. Besides Sycamore, several species of Maple, both Asiatic and North American, are frequently planted in parks.

Natural Order

HIPPOCASTANEÆ. Tab. 25.

DIAGNOSIS.—Trees with opposite digitately-compound leaves. Flowers unsymmetrical, irregular. Stamens hypogynous, 5-8, inserted within a small disk. Ovary free, 3-celled.

DISTRIBUTION.—A small exotic Order chiefly confined to the North Temperate zone, with a few outliers extending along Tropical mountain ranges. Hippocastaneæ are usually regarded as a tribe of Sapindaceæ, from which they differ in habit. The Horse Chestnut (*Æsculus Hippocastanum*), commonly planted for shade and ornament in England, is of Asiatic origin.

FLOWERS frequently unisexual by abortion.

STAMENS usually 7, the calyx and corolla being pentamerous.

FRUIT a capsule, dehiscing loculicidally in 3 valves.

SEEDS exalbuminous; cotyledons large, fleshy, consolidated.

USES, &c.—Excepting the Horse Chestnut, which is a favourite ornamental tree, and one or two North American Pavias occasionally planted, the Order is of little direct importance. The large farinaceous, but bitter seeds of Horse Chestnut are used in some parts of the Continent to feed sheep and goats. The wood is of little value.

Natural Order

LEGUMINOSÆ. Tab. 26.

DIAGNOSIS.—Herbs shrubs or trees, usually with alternate compound stipulate leaves. Flowers irregular (in European genera). Stamens perigynous or subhypogynous (definite in European genera). Pistil of a single carpel. Fruit usually a legume.

This enormous Natural Order is conveniently divided into three Sub orders, characterised thus :—

I. PAPILIONACEÆ.—Flowers irregular *(papilionaceous)*. Petals imbricate; posterior petal outside in bud. Stamens 10, diadelphous, monadelphous, or rarely distinct.

DISTRIBUTION.—Generally dispersed over the Globe from the Arctic zone to the Equator, and ascending mountain-ranges nearly to the limits of flowering vegetation. Many are restricted to certain regions, giving a peculiar stamp to their vegetation. Thus numerous shrubby genera, especially a series with free stamens, are peculiar to Australia; many genera are restricted to the Cape of Good Hope; some affect high elevations, and others are cosmopolitan.

NUMBER OF BRITISH GENERA, 17; Species, 67.

II. CÆSALPINIEÆ.—Flowers usually irregular. Petals imbricate; posterior petal inside in bud. Stamens 10 or fewer.

DISTRIBUTION.—Chiefly Tropical and Subtropical; but two species (the Carob, *Ceratonia*, and Judas-tree, *Cercis)* are European, and none are British.

III. MIMOSEÆ.—Flowers regular. Petals valvate. Stamens definite or indefinite.

DISTRIBUTION.—Chiefly Tropical in both Hemispheres, with a large and remarkable section of the principal genus *(Acacia)*, characterised by leaves reduced to dilated leaf-stalks *(phyllodes)*, almost restricted to Australia. None are European.

LEAVES unifoliolate in Genista ; trifoliolate in Clover (*Trifolium*) ; unequally pinnate in Bird's-foot (*Ornithopus*) and Sainfoin (*Onobrychis*), or the midrib terminating in a tendril in Pea (*Lathyrus*) and Vetch (*Vicia*) ; reduced to a tendril in Yellow Vetchling (*Lathyrus Aphaca*), to a dilated petiole (*phyllode*) in many cultivated Acacias, or to a spine in Furze (*Ulex*) ; exhibiting spontaneous motion in the Telegraph Plant (*Desmodium gyrans*), or remarkable irritability on mechanical stimulus in Sensitive Plant (*Mimosa pudica*).

STIPULES rarely absent ; very large and substituting the suppressed leaflets in Yellow Vetchling.

CALYX gamosepalous, usually 5-toothed ; divided nearly to the base into two concave segments in Furze.

COROLLA in Papilionaceæ of 5 unequal petals, 1 outside, posterior and usually larger, the standard (*vexillum*) ; 2 lateral, the wings (*alæ*) ; 2 anterior, usually cohering more or less by their lower margins, forming a boat-like sheath to the stamens, the keel (*carina*) : keel-petals adherent below to the staminal tube in Clover (*Trifolium*).

STAMENS 10, monadelphous as in Furze and Broom (*Cytisus*) ; diadelphous as in Garden Pea and Clover ; distinct as in Judas-tree ; or indefinite in Acacia.

FRUIT a several-seeded legume opening in two valves along the dorsal and ventral sutures as in Garden Pea and Broom ; a 1-seeded legume as in many Melilots (*Melilotus*) and Red Clover (*Trifolium pratense*) ; 1-seeded and in dehiscentin Sainfoin ; legume more or less deeply divided longitudinally into 2 cells in Astragalus ; indehiscent and inflated in Bladder Senna (*Colutea*) ; divided transversely into 1-seeded ultimately separable joints (*lomentaceous*) as in Bird's-foot (*Ornithopus*) ; spirally twisted in many Medicks (*Medicago*) : drupaceous as in Tonquin-bean (*Dipteryx*) ; matured upon or under the surface of the ground in Earth-nut (*Arachis hypogæa*) and Subterranean Clover (*Trifolium subterraneum*).

SEEDS exalbuminous in British genera.

USES, &c.—AS FOOD-PRODUCING PLANTS:—Pea (*Pisum*), Bean (*Vicia Faba*), Lentil (*Ervum lens*), French beans or Haricots (*Phaseolus vulgaris*), Scarlet-runner (*P. coccineus*), Ground-nut (*Arachis*), Gram or Chick Pea (*Cicer*), Lablab (*Dolichos*), and others.

AS FODDER:—Clover (*Trifolium*), Lucerne (*Medicago*), Sainfoin (*Onobrychis*), Vetch (*Vicia sativa*), Lupines (*Lupinus albus, luteus*, &c.).

AS MEDICINES, ASTRINGENTS, GUMS AND RESINS:—Senna (leaves of Indian and North African species of *Cassia*); Liquorice and Spanish juice (from the root of *Glycyrrhiza glabra* and *G. echinata*, cultivated in South Europe and to a small extent in England); Gum Tragacanth (exuding from the stem of species of *Astragalus* growing in the Levant); Balsam of Peru (from a Central American *Myrospermum*); Balsam of Copaiva (Brazilian species of *Copaifera*); Catechu (*Acacia Catechu* of India); Gum Arabic and Gum Senegal (several African species of *Acacia*); African Copal (*Hymenæa*) and Kino (*Pterocarpus*); Tamarinds (pulp of the fruit of *Tamarindus*, of African origin); Ordeal-bean of Calabar (*Physostigma venenatum*); Divi-divi pods (*Cæsalpinia coriaria* of South America), and many others.

AS DYES:—Indigo (prepared by macerating the herbage of *Indigofera tinctoria, I. Anil* and allies, widely cultivated throughout the Tropics); Logwood (heart-wood of *Hæmatoxylon campeachianum* of Central America); Sappan-wood (*Cæsalpinia Sappan*); Brazil-wood (*C. echinata*); African Cam-wood (*Baphia nitida*); Sanders-wood (*Pterocarpus santalinus*).

AS FIBRE:—Sunn Hemp of India (*Crotalaria juncea*).

AS CABINET WOOD:—Brazilian Rosewood or Palisander-wood, afforded by species of *Dalbergia*; African Rosewood (*Pterocarpus*).

IN ORNAMENTAL CULTIVATION.—North American Locust or Acacia (*Robinia Pseudacacia*); Laburnum (*Cytisus Laburnum*); Spanish Broom (*Spartium junceum*); Bladder Senna (*Colutea*); *Amorpha*; *Wistaria*; *Caragana*; *Coronilla*; *Cytisus*; Lupines (*Lupinus*, various species); Scarlet-runner (*Phaseolus coccineus*); Coral-tree (*Erythrina*); many Australian species of *Chorizema, Oxylobium, Kennedya, Acacia*, &c.; New Zealand *Edwardsia* and *Clianthus*; Cape *Podalyria*, and many others.

Natural Order

ROSACEÆ. Tab. 27, 28, 29.

DIAGNOSIS.—Herbs, shrubs or trees, with alternate stipulate leaves. Flowers usually regular. Stamens perigynous, indefinite or definite. Pistil apocarpous or spuriously syncarpous, of one or more carpels. Seeds exalbuminous.

A large and very important Natural Order, including several distinct types of structure distinguished as Sub-orders, of which the more important are :—

I. CHRYSOBALANEÆ.—Flowers often slightly irregular. Carpel 1, free; style basal. Ovules 2, ascending.

DISTRIBUTION.—Wholly confined to Tropical and Subtropical countries of both the Old and New World, though most numerous in the latter.

II. PRUNEÆ (Tab. 27).—Flowers regular. Carpel 1, rarely 2 or more, free; style terminal. Ovules 2, pendulous. Fruit a drupe.

DISTRIBUTION.—Principally confined to the Temperate zone of the Northern Hemisphere, with a few Intertropical outliers, chiefly along mountain ranges. None are known from the South Temperate zone.

ONE BRITISH GENUS; Species, 3.

III. SPIRÆACEÆ.—Flowers regular. Carpels usually about 5, rarely solitary, free; style terminal. Ovules 1-2 or more, pendulous. Fruit usually follicular.

DISTRIBUTION.—Chiefly restricted to the North Temperate zone; four genera are peculiar to Japan and China, and four to North America.

ONE BRITISH GENUS; Species, 2.

IV. DRYADEÆ (Tab. 28).—Flowers regular. Carpels usually 5 or more, inserted upon a convex disk, free; styles subterminal. Ovules 2 or 1. Fruit a head of achenes or drupels.

DISTRIBUTION.—Chiefly belonging to the North Temperate zone, with 4 or 5 genera penetrating into the Tropics. Two of the largest genera, Bramble (*Rubus*) and *Potentilla*, are cosmopolitan, though most numerous in cool regions.

NUMBER OF BRITISH GENERA, 7; Species, 20.

V. POTERIEÆ.—Flowers small, regular, usually apetalous. Stamens definite or indefinite. Carpels 1-3, free. Ovule 1. Fruit an achene inclosed within the dry persistent calyx-tube.

DISTRIBUTION.—Most abundant in the North Temperate zone and along mountain chains of the Tropics. The largest genus (*Cliffortia*) is almost restricted to the Cape of Good Hope.

NUMBER OF BRITISH GENERA, 4; Species, 7.

VI. ROSEÆ.—Flowers regular. Stamens indefinite. Carpels indefinite, free, inserted upon a hollow receptacle. Ovule 1, pendulous. Fruit-achenes inclosed in a succulent receptacle ("calyx-tube").

DISTRIBUTION.—This Sub-order is based solely on the genus Rose (*Rosa*), which is almost restricted to the North Temperate zone, and more numerous in the Old World than in the New. A few extend southward between the Tropics, but none are indigenous in the South Temperate zone.

ONE BRITISH GENUS; Species, 6-12.

VII.—POMACEÆ (Tab. 29).—Flowers regular. Stamens indefinite. Carpels 1-5, the ovaries inferior, inclosed by the adherent receptacle or calyx-tube. Ovules usually 2, ascending. Fruit succulent.

NUMBER OF BRITISH GENERA, 3; Species, 8.

LEAVES simple as in Apple, Pear (*Pyrus*), Cherry (*Prunus*), Almond (*Amygdalus*), and Thorn (*Crataegus*): or digitately trifoliolate or quinquefoliolate as in Strawberry (*Fragaria*) and some Potentillas; or pinnate as in Silverweed (*Potentilla anserina*) and Rose.

FLOWERS pentamerous or tetramerous; apetalous in Lady's Mantle (*Alchemilla*) and the Burnets (*Poterium* and *Sanguisorba*); involucrate in Potentilla and Lady's Mantle.

STAMENS indefinite; or definite in Great Burnet (*Sanguisorba*) and Lady's Mantle.

FRUIT various; a solitary drupe, with a smooth stone (*putamen*) in Cherry, or with a wrinkled stone in Peach and Almond; numerous minute drupes (*drupels*) upon a conical receptacle in Blackberry and Raspberry (*Rubus*); a single free achene inclosed in the dried receptacle in Burnet; a head of achenes upon a convex dry receptacle in Potentilla, or upon a fleshy convex receptacle in Strawberry (*Fragaria*), or inclosed in a succulent receptacle in Rose; a whorl of small follicles in Meadow-Sweet (*Spiræa*); a fleshy receptacle investing and adnate to the cartilaginous carpels in Apple and Pear (*Pyrus*), or to bony carpels as in Thorn (*Crataegus*).

USES, &c.—The Natural Order Rosaceæ includes nearly all of our more valuable orchard trees as well as many of our most beautiful garden flowers.

The tropical group CHRYSOBALANEÆ includes a few species affording edible fruit, as the Cocoa Plum of the West Indies (*Chrysobalanus Icaco*). The bark of the Caraipi or Pottery-tree (*Moquilea*) of the Amazons, powdered and mixed with clay, is used in making utensils capable of withstanding a great heat.

To PRUNEÆ belong the Cherry, Apricot, Plum and Bullace (*Prunus*), Almond, Peach, and Nectarine (*Amygdalus*), also the Cherry-laurel (*Prunus Lauro-cerasus*) and Portugal Laurel (*P. lusitanica*), planted in every shrubbery.

SPIRÆACEÆ.—To this group belong numerous cultivated ornamental species, horticultural varieties and hybrids of the genus *Spiræa*, chiefly of North American and Asiatic origin, also *Kerria japonica*, an old denizen of cottage gardens introduced from China and Japan.

DRYADEÆ include the Raspberry (*Rubus idæus*) and Blackberry (*R. fruticosus*), Strawberry (*Fragaria vesca*), and ornamental garden species of Potentilla and Avens (*Geum*).

SANGUISORBEÆ are of but small economic importance. Burnet (*Sanguisorba*) is a fodder-plant and a few species of the group are applied in rude medicine.

ROSEÆ.—To the genus *Rosa* belong the innumerable garden varieties and hybrids, almost invariably double-flowered owing to the development of petals at the expense of the essential organs of the flower, derived from a few species, which have been cultivated for the sake of their beautiful flowers from time immemorial. Of these cultivated species the principal are *Rosa centifolia* and *R. gallica* (probably a variety of *R. centifolia*), from which are derived the Common Cabbage, Moss and Provence Roses; *R. alba*, the White Rose; *R. indica*, the various Tea Roses; *R. bengalensis*, the Monthly and China Roses; *R. arvensis*, Ayrshire Rose; and *R. rubiginosa*, the Sweet Briar. Attar or Otto of Rose is obtained in South Europe, especially in Turkey, in Persia and Northern India, from the petals of *R. moschata*, *R. damascena*, and *R. centifolia*.

POMACEÆ include the Apple (*Pyrus Malus*), Pear (*R. communis*), Siberian Crab (*P. prunifolia*), Service-tree (*P. domestica*), Quince (*Cydonia vulgaris*), Medlar (*Mespilus germanica*), and the Loquat of China and Japan (*Eriobotrya japonica*). To the same group belong Common Hawthorn (*Cratægus Oxyacantha*), everywhere used as a hedge-plant, and the Rowan or Mountain Ash (*Pyrus Aucuparia*), *Cratægus Pyracantha*, and several North American species of Cratægus common in shrubberies, as also a few cultivated species of *Cotoneaster*, of which genus a single species is indigenous in Britain, growing upon the limestone cliffs of Great Orme's Head in North Wales.

Natural Order

SAXIFRAGEÆ. Tab. 30.

DIAGNOSIS.—Herbs with radical or alternate exstipulate cauline leaves. Flowers regular, pentamerous. Stamens perigynous, definite. Ovary 2-celled, superior or inferior. Ovules indefinite.

DISTRIBUTION.—Principally confined to the North Temperate and Arctic zones and higher mountain ranges of the Tropics; a few extending far along the South American Cordillera. A large proportion of the species of the only large genus of the Order, Saxifrage (*Saxifraga*), affects rocky stations at alpine elevations.

NUMBER OF BRITISH GENERA, 3; Species, 15.

STAMENS 10 or 5, subhypogynous in some species of Saxifraga, as London Pride (*S. umbrosa*).

OVARY inferior, as in Rue-leaved Saxifrage (*S. tridactylites*); half-inferior, as in Meadow Saxifrage (*S. granulata*); superior, as in London Pride.

FRUIT a many-seeded capsule.

SEEDS usually albuminous.

USES, &c.—Numerous species of Saxifraga are cultivated for ornament, especially on rockwork and in cool borders. None are of economic importance. The Hydrangea, an ornamental Chinese shrub, in the cultivated form of which the lobes of the calyx are inordinately developed at the expense of the essential organs of the flower, belongs to a closely allied group (*Hydrangeæ*), usually regarded as a tribe of Saxifrageæ, differing from the type in having opposite leaves.

Natural Order

RIBESIACEÆ. Tab. 31.

DIAGNOSIS. – Shrubs with alternate leaves. Flowers small, regular. Stamens perigynous, 5 or 4. Ovary inferior, 1-celled with indefinite parietal ovules.

DISTRIBUTION.—Based upon the solitary genus Currant *(Ribes)*, the species of which belong to the North Temperate zone of both the Old and New World, and high mountain chains of the Tropics. Five species extend north of the Arctic circle, including the Red and Black Currant (*R. rubrum* and *R. nigrum*).

ONE BRITISH GENUS; Species, 4.

STEM sometimes bearing infra-axillary spines, as in Gooseberry (*Ribes Grossularia*).
PETALS 4-5, minute, inserted on the calyx.
FRUIT a berry.

USES, &c.—To this small Order belong:—Gooseberry (*Ribes Grossularia*), of which there are numerous cultivated varieties with smooth or bristly, green or red fruit; Red and White Currants (*R. rubrum*), indigenous in Britain; and Black Currant (*R. nigrum*). Several species of Currant, chiefly North American, are grown in shrubberies, as the so-called Red Flowering Currant (*R. sanguineum*).

Remarkably different in habit, but agreeing in the inferior ovary with indefinite parietal ovules, is the almost exclusively American Natural Order CACTACEÆ, nearly all the species of which are leafless, very succulent, often spinose, with globose, columnar, rope-like, or jointed stems. Their flowers are usually very handsome, rose or pale yellow. A number of species are cultivated in our plant-houses, and a species of Indian Fig or Prickly Pear (*Opuntia vulgaris*) is widely naturalised in countries around the Mediterranean. It is upon this plant and its allies, cultivated in Mexico and the Canary Islands, that the Cochineal insect feeds.

Natural Order

CRASSULACEÆ. Tab. 32.

DIAGNOSIS.—Herbs (or shrubs) with fleshy, usually alternate, exstipulate leaves. Flowers regular. Stamens perigynous, definite. Carpels as many as calyx-lobes, free or nearly so, with indefinite ovules.

DISTRIBUTION.—A considerable and wide-spread Natural Order of temperate and warm climates, with a few Arctic species; represented both in the Old and New World: most numerous at the Cape of Good Hope, where their relative abundance lends further peculiarity to a very remarkable Flora. Many grow upon rocks or the most arid soil.

NUMBER OF BRITISH GENERA, 4; Species, 12.

LEAVES opposite in the minute annual *Tillæa*. The succulent leaves of the Tropical *Bryophyllum calycinum* freely produce adventitious buds in their crenatures when placed on damp soil.

SEPALS united at the base, 5, rarely fewer, or varying up to 20 in Houseleek (*Sempervivum*).

STAMENS as many, or twice as many, as sepals; the anthers of Houseleek are frequently monstrous, bearing ovules.

USES, &c.—Houseleek and Orpine or Livelong (*Sedum Telephium*), and a few others, are used in rustic medicine. Species of Stonecrop (*Sedum*) are grown upon rockwork, and the crimson *Rochea coccinea* of the Cape of Good Hope and several Cape and Mexican Cotyledons and Echeverias are frequent in parlour and greenhouse cultivation.

Natural Order

DROSERACEÆ. Tab. 33.

DIAGNOSIS.—Low herbs, usually with glandular radical leaves. Flowers regular. Stamens hypogynous or nearly so, usually 5. Ovary free, with parietal placentas. Fruit a capsule.

DISTRIBUTION.—A small, but almost cosmopolitan Natural Order. Of the principal genus, Sundew (*Drosera*), a number of species are peculiar to Australia and Cape of Good Hope. They affect either boggy or sandy localities.

ONE BRITISH GENUS; Species, 3.

LEAVES of Sundew covered with scattered stalked glands which exhibit tardy irritability when a crumb of some foreign substance is placed upon them; in Venus' Fly-trap (*Dionæa muscipula*), peculiar to the Southern United States, the blade of the leaf is 2-lobed, each lobe bearing a fringe of bristles and 3 minute bristles on the disk; the latter are remarkably sensitive to mechanical irritation, and when touched cause the instantaneous folding of the lobes of the blade.

FLOWERS very fugacious.

USES, &c.—The Order is of no economic importance. A few Australian species of Sundew and the Venus' Flytrap are occasionally cultivated in greenhouses.

Natural Order

LYTHRACEÆ. Tab. 34.

DIAGNOSIS.—Herbs (or shrubs), usually with opposite leaves. Calyx tubular or campanulate. Stamens perigynous, usually definite. Ovary free, with 2 or more cells and indefinite ovules; style 1.

DISTRIBUTION.—The woody genera are chiefly Tropical, while many of the herbaceous genera, especially those affecting marshy localities, are cosmopolitan.

NUMBER OF BRITISH GENERA, 2; Species, 3.

CALYX in Purple Loosestrife (*Lythrum*) with twice as many teeth as petals.

PETALS equal; or unequal in *Cuphea*.

STAMENS in Loosestrife in two unequal series, and never equal in length to the pistil, in the same plant. Mr. Darwin has shown that the species is most productive of good seed when the pistil is fertilised by pollen transferred from stamens corresponding in length to the pistil. As these are necessarily borne upon a distinct plant the transference can only take place through adventitious, especially insect, agency.

USES, &c.—None are of much economic importance. Henna, a dye used by Mahometan ladies to dye their nails, &c., consists of the powdered leaves of *Lawsonia inermis*. Species of the American genus *Cuphea* are in garden cultivation.

Natural Order

MYRTACEÆ. Tab. 35.

DIAGNOSIS.—Trees or shrubs, with opposite entire translucently-dotted leaves. Flowers regular. Stamens indefinite. Pistil syncarpous; ovary inferior.

DISTRIBUTION.—A very large Natural Order, almost confined to Tropical and Subtropical countries of both Hemispheres and to Australia. About thirty genera are peculiar to Australia, including the large genus *Eucalyptus*, and the remarkable group of Chamælaucieæ, characterised by a 1-celled ovary and frequently involucrate flowers. Common Myrtle (*Myrtus communis*) is the only indigenous European representative of the Order.

LEAVES glandular-dotted and usually exhibiting a vein immediately within and parallel to the margin.

PETALS united and thrown off on expansion in *Eucalyptus*.

FRUIT various, dry or succulent. In Brazil-nut (*Bertholletia*) and its allies, a woody capsule opening by a transverse lid.

USES, &c.—Several Australian species of *Eucalyptus*, which includes the Iron-barks, Gum-trees and Stringy-barks of Colonists, afford valuable timber. The Guava (*Psidium Guava*), Rose Apple (*Jambosa vulgaris*), and Brazil-nut (*Bertholletia excelsa*), are tropical fruits of the Order, and the Pomegranate (*Punica Granatum*) of a near ally, probably indigenous in Western Asia. Cloves are the dried flower-buds of *Caryophyllus aromaticus*, originally brought from the Moluccas, now extensively cultivated in Africa and the West Indies; Clove-pepper or Allspice, the fruit of *Pimenta vulgaris*, cultivated in Jamaica. Myrtaceæ generally abound in an aromatic volatile oil, the presence of which gives character to the products of the Order.

Natural Order

ONAGRACEÆ. Tab. 36.

DIAGNOSIS.—Herbs with opposite or alternate simple leaves. Calyx-lobes valvate in bud. Stamens perigynous, definite. Ovary inferior, usually 4-celled.

DISTRIBUTION.—A considerable cosmopolitan Natural Order, most numerous in America. The head-quarters of Fuchsia is in Mexico and South America, with outliers in New Zealand.

NUMBER OF BRITISH GENERA, 3; Species, 13.

FLOWERS usually tetramerous; in Enchanter's Nightshade (*Circæa*) dimerous.

CALYX coloured in Fuchsia.

PETALS usually sessile; clawed and three-lobed in Garden *Clarkia*.

FRUIT, a capsule, very long and narrow in Willow-herb (*Epilobium*); a berry in Fuchsia.

SEEDS with a tuft of hairs (*comose*) in Willow-herb.

USES, &c.—Many of the Onagraceæ are gay garden-flowers, as Fuchsia, of which several species are in cultivation, introduced from Chili and Brazil; *Clarkia*, Evening Primrose (*Œnothera*), *Gaura* and *Lopezia* also from the New World, and the Rose-bay Willow-herb, a species indigenous in Britain. Water Chestnut (*Trapa natans* and allies) affords a horned bony 1-seeded fruit, containing a farinaceous embryo, collected as food in Tibet and China.

Natural Order

HALORAGEÆ. Tab. 37.

DIAGNOSIS.—Herbs, usually aquatic, with whorled opposite or alternate leaves often, dissected when submerged, and minute flowers. Stamens epigynous, 1-8. Ovary inferior, 1-4-celled.

DISTRIBUTION.—A small Natural Order, but, as is usual with aquatics, widely dispersed over the Globe. The British genera especially are cosmopolitan.

NUMBER OF BRITISH GENERA, 4; Species, 7.

LEAVES whorled, narrow-linear in Mare's-tail (*Hippuris*); pectinate in Water Milfoil (*Myriophyllum*).

FLOWERS apetalous and monandrous in Mare's-tail; unisexual, naked and monandrous in *Callitriche*.

USES, &c.—None of the Order are of economic value. *Gunnera scabra*, a Patagonian species with large and striking rhubarb-like foliage, is frequently planted on lawns.

MELASTOMACEÆ is a large extra-European Natural Order allied to Lythraceæ and Onagraceæ, characterised by opposite 3-nerved leaves, showy flowers with definite perigynous stamens usually bearing remarkably appendaged anthers opening by pores, and ovary generally adherent to the calyx-tube.

DISTRIBUTION.—Almost exclusively Intertropical, common to both the Old and New World, though by far most numerous in America.

USES, &c.—Melastomaceæ do not afford any product of much importance to mankind, but being nearly all gay-flowered, many species, chiefly of the genera *Medinilla*, *Pleroma*, *Centradenia*, *Osbeckia*, *Monochætum* and *Sonerila*, are represented in cultivation in hothouses. The fruit in *Melastoma* is baccate and edible, and, staining the lips black, gives name to the genus and so to the Order.

BEGONIACEÆ, a Natural Order consisting almost solely of the large extra-European genus *Begonia*, allied to Cucurbitaceæ, but remarkably different in habit, may be distinguished by the succulent unequal-sided stipulate leaves, inferior usually 3-celled ovary with very numerous ovules, and winged fruit. The flowers are unisexual, the staminate and pistillate flowers usually dissimilar in the perianth.

DISTRIBUTION.—Almost wholly Tropical and Subtropical; most numerous in Asia and America; none have been found in Australia.

USES, &c.—Many species are grown in plant-houses for the sake both of their showy usually white or flesh-coloured flowers, and remarkable, often beautifully-variegated leaves. Two or three species are said to be used as pot-herbs, and a few as medicines.

Natural Order

CUCURBITACEÆ. Tab. 38.

DIAGNOSIS.—Climbing herbs with alternate palminerved leaves and extra-axillary tendrils. Flowers unisexual. Stamens perigynous, usually 3. Ovary inferior. Fruit succulent.

DISTRIBUTION.—A considerable Natural Order common to both the Old and New World; most numerous in Tropical and Subtropical countries.

ONE BRITISH GENUS; Species, 1.

FLOWERS regular, usually pentamerous; dicœcious in Bryony (*Bryonia dioica*) and many other genera.

STAMENS 3, one bearing half an anther; anther-cells in Bryony sinuous.

OVARY in Bryony separated from the limb of the calyx by a deep constriction; placentas fleshy, 3, infolded to the centre of the ovary, then reflected to near the periphery.

SEEDS exalbuminous.

USES, &c.—This important Order is generally characterised by much acridity, which, however, in the fruits of the numerous species under cultivation, is diffused or wholly wanting. Amongst edible Cucurbitaceæ are the Cucumber (*Cucumis sativus*), Melon (*C. melo*), Water Melon (*Citrullus vulgaris*), the infinite variety of Gourds and Pumpkin (*Cucurbita maxima* and allies), and Vegetable Marrow (*C. Pepo*). After removal of the pulp, the shell-like outer layer of the fruit of *Lagenaria*, which is most variable in size and form, serves for water-vessels, domestic utensils, drums, and innumerable other purposes. Colocynth, the fruit of *Citrullus Colocynthis*, is intensely bitter and poisonous. It is employed medicinally, as was formerly Elaterium, prepared from the fruit of the Squirting Cucumber (*Momordica Elaterium*). The latter plant takes its name from the mode in which the seeds are discharged by the ripe fruit. On separating from the stalk the elastic sides of the fruit collapse and expel the contained pulp with considerable force.

Natural Order

PASSIFLOREÆ. Tab. 39.

DIAGNOSIS.—Stem usually climbing, with alternate leaves and axillary tendrils. Flowers regular. Calyx-tube fringed within. Stamens usually 4-5. Ovary free, 1-celled with parietal placentas.

DISTRIBUTION.—A small extra-European Natural Order, almost wholly confined to Tropical and Subtropical regions; common to both Hemispheres, though by far the larger proprortion of the largest and typical genus Passion-flower (*Passiflora*) belongs to the New World. Of the remaining seventeen genera ten are peculiar to Africa and its islands.

CALYX in Passion-flower with a short cup-shaped tube; in *Tacsonia* with a cylindrical, often long tube.

STAMENS in Passion-flower 4–5, the filaments adnate below to the stalk of the ovary; anthers versatile.

OVARY in the same on a distinct stalk (*gynophore*), 1-celled, with 3 spreading styles.

USES, &c.—Several species of Passion-flower, including the Granadilla (*Passiflora quadrangularis*), bear pulpy agreeably acid fruits, eaten in the West Indies and Tropical America. The root, foliage and flowers, on the other hand, are often dangerous, and afford preparations of medicinal repute in America. Several species and garden varieties or hybrids of Passion-flower, chiefly *Passiflora cærulea*, *P. kermesina*, *P. racemosa*, *P. Banksii* of Queensland, and their derivatives, and a few species of *Tacsonia*, are well-known beautiful climbers of our plant-houses.

Natural Order

UMBELLIFERÆ. Tab. 40.

DIAGNOSIS.—Herbs with hollow stem, alternate usually divided leaves and umbellate flowers. Stamens epigynous, 5. Ovary inferior, 2-celled. Fruit dry, 2-seeded.

DISTRIBUTION.—A large Natural Order represented in every quarter of the Globe, but most numerous in Europe and Temperate Asia; especially characteristic of the vegetation of countries bordering the Mediterranean.

NUMBER OF BRITISH GENERA, 39; Species 57.

LEAVES usually much cut: entire, round, and peltate in Hydrocotyle; entire and perfoliate in Thorow-wax (*Bupleurum rotundifolium*); rigid and spinose in Sea Holly (*Eryngium*); dissected with filiform segments in Fennel (*Fœniculum*), with fleshy segments in Samphire (*Crithmum*).

FLOWERS usually in terminal compound umbels, hermaphrodite and staminate, frequently irregular owing to the larger development of the petals turned from the centre of the umbel; umbels lateral in Celery (*Apium*), being overtopped by an axillary shoot; flowers capitate in Sea Holly. Involucre occasionally wanting, as in Fennel.

CALYX adherent; limb obsolete, or reduced to small teeth as in Sanicle (*Sanicula*), and Astrantia.

PETALS epigynous, 5; usually obcordate with incurved tips.

FRUIT (*a cremocarp*), laterally compressed in Hemlock (*Conium*), yet more so in Hydrocotyle; dorsally compressed in Cow Parsnip (*Heracleum*): separating when ripe into two carpels (*mericarps*) from a short central forked axis (*carpophore*): carpels smooth as in Chervil (*Anthriscus*); with winged primary ridges (answering to the carinal and sutural lines of the united sepals) as in Prangos; with winged secondary ridges (alternating with the carinal and sutural lines of the sepals) as in Laserpitium; with plaited-toothed ridges as in Astrantia; with bristly primary and prickly secondary ridges as in Carrot (*Daucus*): pericarp thin, often with longitudinal oil-canals (*vittæ*) as in Cow Parsnip.

SEED solitary in each mericarp, albuminous.

USES, &c.—While very many of the Umbelliferæ are acrid and poisonous, some of them virulently so, as Hemlock (*Conium maculatum*), Cowbane (*Cicuta virosa*) and Dropwort (*Œnanthe crocata*) which are all British species, others, especially under cultivation in dry soil or by blanching, lose their acridity and become valuable esculents, as Celery (*Apium graveolens*), Carrot (*Daucus Carota*), Parsnip (*Pastinaca sativa*). The fruit is often aromatic and stimulant, serving as a condiment or spice, as Caraways (*Carum Carui*), Corianders (*Coriandrum sativum*) Anise (*Anisum*), Cumin (*Cuminum*). A few species of Western and Central Asia afford important gum-resins, as Ammoniacum (*Dorema ammoniacum*), Asafœtida (*Narthex asafœtida* and *Scorodosma fœtidum*), Galbanum (*Ferula galbaniflua*), and Sagapenum of unknown origin. To this Order belong also Parsley (*Petroselinum sativum*) Fennel (*Fœniculum vulgare*), Samphire (*Crithmum maritimum*), Archangel (*Angelica archangelica*), Sweet Cicely (*Myrrhis odorata*), and several other species used as esculents or condiments.

A few tall species of Heracleum and Ferula are occasionally grown on lawns for the sake of their striking foliage and picturesque habit, and Astrantia with conspicuous and elegantly veined involucral bracts in gardens.

Natural Order

ARALIACEÆ.

DIAGNOSIS.—Generally agreeing with Umbelliferæ, differing, not in any absolute character, but usually either in having a woody stem, or more numerous cells in the ovary, or a berried fruit.

DISTRIBUTION.—A small Natural Order, chiefly Tropical, though with several outlying representatives in both the North and South Temperate zone, especially in Eastern Temperate Asia. Ivy (*Hedera Helix*) is the only European representative of the Order.

ONE BRITISH GENUS; Species, 1.

OVARY 5-celled, ovules solitary in Ivy.

SEEDS with ruminated albumen and inclosed in a membranous layer of the pericarp in Ivy.

USES, &c.—Rice-paper is prepared from the copious white pith of a small Formosan tree (*Fatsia papyrifera*). Ginseng, the dried root of a *Panax* growing in North China or Mantchuria, is in great repute in China as a restorative medicine, though destitute of any important properties. Besides Ivy, of which there are several cultivated varieties, a few exotic species of *Aralia* are grown for the sake of their picturesque habit.

Natural Order

LORANTHACEÆ. Tab. 41.

DIAGNOSIS.—Parasitical evergreen shrubs, usually with jointed stems and opposite entire leaves. Stamens opposite the perianth lobes. Ovary inferior, with a solitary erect adherent ovule.

DISTRIBUTION.—By far the larger proportion of this considerable Natural Order is confined to the Tropics, where the prevailing genus, *Loranthus*, common to both Hemispheres, is often very gaily flowered. Many occur in the South Temperate zone, and but few in the Northern. Three species of as many genera are European.

ONE BRITISH GENUS; Species, 1.

FLOWERS of Mistletoe (*Viscum*) dicœcious, with a minute simple 4-leaved epigynous perianth; in Loranthus, perianth-segments distinct or equally or unequally connate, occasionally a few inches in length and brilliantly coloured, surrounded at the base by a calyx-like disk.

ANTHERS of Mistletoe dehiscing in numerous pores; opposite to and sessile upon the leaves of the perianth.

SEED albuminous; in Mistletoe frequently containing more than one embryo; surrounded by a viscous layer of the pericarp which secures the attachment of the seed to the bark of the tree upon which the future parasite is to prey.

USES, &c.—Several tropical species of Loranthus have a medicinal repute in their respective countries. None are cultivated, owing to their parasitical habit. Mistletoe, the only British representative of the Order, has been a special object of popular regard from a remote period, no doubt from its peculiarity as our only conspicuous green-leaved parasite.

Natural Order

CORNACEÆ. Tab. 42.

DIAGNOSIS.—Usually shrubs or trees with opposite simple exstipulate leaves. Flowers regular. Stamens epigynous, as many as petals and alternate with them.

DISTRIBUTION.—A small Natural Order, chiefly confined to the North Temperate zone, both in the Old and New World.

ONE BRITISH GENUS; Species, 2.

FLOWERS cymose in Dogwood (*Cornus sanguinea*), umbellate and involucrate in Dwarf Cornel (*C. suecica*), capitate and consolidated in Garden Benthamia (*Benthamia fragifera*).

USES, &c.—Charcoal suitable for the finer sorts of gunpowder is stated to be afforded by the wood of Dogwood. The "Variegated Laurel" of our shrubberies is the pistillate plant of a dioecious Japanese species (*Aucuba japonica*): the staminate plant has been recently introduced. A few species of Cornus, the Asiatic *Benthamia fragifera*, and one or two species of the anomalous North American genus *Garrya* are also cultivated.

DICOTYLEDONS WITH GAMOPETALOUS FLOWERS.

Natural Order

CAPRIFOLIACEÆ. Tab. 43.

DIAGNOSIS.—Shrubs, frequently climbing, rarely trees or herbs, with opposite leaves. Corolla epigynous, regular or irregular. Ovary inferior, 2-5-celled.

DISTRIBUTION.—A rather small Natural Order. Most of the species belong to the North Temperate zone and cooler Intertropical regions.

NUMBER OF BRITISH GENERA 5; Species, 7.

FLOWERS regular and rotate or funnel-shaped in Elder (*Sambucus*) and Laurustinus (*Viburnum Tinus*); tubular and irregular (*bilabiate*) in Honeysuckle (*Lonicera*); in Guelder Rose (*Viburnum Opulus*) the corolla of the outer flowers of the inflorescence enlarges at the expense of the essential organs, which thus become neuter; capitate in Moschatel (*Adoxa*), the uppermost flower tetramerous, the lateral pentamerous.

STAMENS usually as many as corolla-lobes and alternate with them; filaments forked in Moschatel, each division bearing half an anther.

USES, &c.—The berries of Elder (*Sambucus nigra*) are used in some domestic preparations, and the bark of allied North American species has repute as a febrifuge. Many are cultivated in shrubberies, especially of the genera Honeysuckle or Woodbine (*Lonicera*) and Viburnum. To the latter belongs the Garden Laurustinus, introduced from Southern Europe.

Natural Order

CAMPANULACEÆ. Tab. 44.

DIAGNOSIS.—Herbs, rarely shrubs or climbers, with milky juice, usually alternate leaves and regular bell-shaped flowers. Stamens epigynous, as many as corolla-lobes and alternate with them. Ovary inferior, 2 or more-celled, with numerous ovules.

DISTRIBUTION.—A considerable and widely-dispersed Natural Order, most numerous in the North Temperate zone and at the Cape of Good Hope.

NUMBER OF BRITISH GENERA, 3; Species, 12.

CALYX adherent, with a 5-lobed limb; in Canterbury-bell (*Campanula Medium*) with supplementary segments, from the intervals between the calyx-lobes, sharply reflexed and concealing the ovary.

COROLLA epigynous, bell-shaped (*campanulate*) or tubular, often deeply divided into 5 segments, valvate in æstivation.

STAMENS free; anthers discharging their pollen before expansion of the corolla; in Sheep's-bit (*Jasione*) with the anthers cohering at the base.

STYLE with longitudinal rows of ultimately retractile hairs, as in Campanula, which collect the pollen from the anthers and expose it after the fading of the latter to be transported by insects to the stigmas of other flowers.

FRUIT a many-seeded capsule, dehiscing variously.

SEEDS albuminous.

USES, &c.—The fleshy root of Garden Rampion (*Campanula Rapunculus*) is an esculent occasionally cultivated in Britain, but the Order generally abounds in a more or less acrid juice. Very few are turned to economic account. Several species, however, are favourite ornamental garden plants, as Canterbury-bell and other species of Campanula, Venus' Looking-glass (*Specularia*), *Canarina* and *Musschia*; the two latter genera peculiar to the Canary Islands.

Natural Order

LOBELIACEÆ.

DIAGNOSIS.—Herbs, or rarely shrubs, with milky juice, alternate leaves and irregular flowers. Stamens epigynous, as many as corolla-lobes and alternate with them; anthers syngenesious. Ovary inferior.

DISTRIBUTION.—A small Natural Order very nearly allied to Campanulaceæ, of which it is usually regarded as a Tribe, differing in the irregular flowers and more completely coherent anthers. Chiefly Tropical, South Temperate and North American.

ONE BRITISH GENUS; Species 2.

CALYX adherent or rarely nearly free, with a 5-lobed limb.

COROLLA usually epigynous, the limb 1 or 2-lipped and the tube longitudinally split in Lobelia.

ANTHERS coherent in a tube around the style.

FRUIT a capsule or berry.

USES, &c.—The species are generally dangerous, acrid and narcotic. A few American species are used medicinally. The brilliant scarlet-flowered *Lobelia cardinalis* of the United States and the blue *L. Erinus* of the Cape of Good Hope are commonly cultivated for ornament, as are also in plant-houses Tropical American species of *Centropogon* and *Siphocampylus*.

Natural Order

ERICACEÆ. Tab. 45.

DIAGNOSIS.—Shrubs or wiry undershrubs, usually with alternate often evergreen leaves. Flowers regular or nearly so. Stamens free from the corolla, usually twice as many as its lobes; anthers usually opening by pores. Ovary several-celled.

DISTRIBUTION.—A large and tolerably homogeneous Natural Order, widely dispersed over the Globe; most numerous in cool regions either of latitude or elevation; rare in Australia and Tropical Africa. The principal genus of the Order, Heath (*Erica*), is remarkably numerous in species in a restricted area at the Cape of Good Hope. One or two social species of the same genus cover enormous areas of moorland in Northern Europe.

The genera of Ericaceæ may be grouped under the following tribes :—

I. ERICINEÆ.—Corolla gamopetalous, hypogynous. Fruit dry or succulent.

NUMBER OF BRITISH GENERA, 6; Species, 13.

II. VACCINIEÆ.—Corolla gamopetalous, epigynous. Fruit succulent.

NUMBER OF BRITISH GENERA, 2; Species, 4.

III. PYROLEÆ.—Uusually herbs. Petals distinct, hypogynous. Fruit capsular.

ONE BRITISH GENUS; Species 5.

LEAVES usually evergreen; deciduous in Azalea; in Heath (*Erica*) narrow with revolute margins; in Winter-green (*Pyrola*) round and radical, or nearly so.

FLOWERS slightly irregular in Rhododendron and Azalea; the corolla dry and persisting after flowering (*marcescent*) in Ling and Heath.

ANTHERS usually with spur-like appendages.

FRUIT superior and baccate as in Strawberry-tree (*Arbutus*); inferior and baccate as in Cranberry and Bilberry (*Vaccinium*); or a capsule with the valves separating from the axis by the splitting of the dissepiments, as in Rhododendron and Ling, or by the splitting of the median line of the cavities as in Heath.

USES, &c.—The agreeably acid fruit of Cranberry (*Vaccinium Oxycoccos* and *V. macrocarpum*), the insipid berries of Bilberry or Whortleberry (*V. Myrtillus*), and the fruits of other berry-bearing species, are collected in Northern latitudes for culinary purposes and dessert. A few are used medicinally. Rhododendron and its allies are narcotic and dangerous, and honey prepared from their flowers is said to be sometimes poisonous.

The Order includes a very large number of favourite ornamental species in general cultivation, as North American and Himalayan species of Rhododendron, and the old denizen of our shrubberies *Rhododendron ponticum* of South Europe; American and Asiatic species of Azalea, differing from Rhododendron in their deciduous leaves and stamens equalling in number the corolla-lobes; North American Kalmias, remarkable for the depressions in the corolla in which the anthers nestle before discharging their pollen; very numerous species and garden varities of Heath (*Erica*) introduced from the Cape of Good Hope; American Andromedas, Thibaudias, Macleanias and their allies, with many others.

Natural Order

EPACRIDACEÆ.

DIAGNOSIS.—General characters of Ericaceæ, (Tribe Ericineæ), and nearly resembling Heaths in habit; differing in the stamens, which are usually the same number as corolla-lobes, bearing unappendaged 1-celled anthers.

DISTRIBUTION.—Confined to Australia, New Zealand and some Islands of the Antipodes, where the Order represents the true Heaths, which are absent from Australasia.

USES, &c.—Epacridaceæ are not of economic importance, but contribute several very ornamental heath-like plants to our greenhouses. *Epacris longiflora, E. impressa*, and their numerous varieties are old established favourites.

Natural Order

RUBIACEÆ. Tab. 46, 47.

DIAGNOSIS.—Herbs, shrubs or trees, with opposite leaves and interpetiolar stipules, or herbs with verticillate leaves. Corolla regular, epigynous. Stamens epipetalous, alternate with the lobes of the corolla. Seeds albuminous.

The species of this very large Natural Order are grouped, very unequally as to numbers, by characters recognisable at sight, into the Sub-orders:—

I. STELLATÆ (Tab. 46).—Herbs. Leaves verticillate.

DISTRIBUTION.—Widely dispersed over the Globe, though most numerous in the North Temperate zone. The principal genera are indigenous in Britain.

NUMBER OF BRITISH GENERA, 4; Species, 15.

II. CINCHONACEÆ (Tab. 47).—Leaves opposite, with interpetiolar stipules.

DISTRIBUTION.—Extra-European, but in Tropical and Subtropical countries of both Hemispheres, one of the three or four largest Natural Orders of Dicotyledons, including, besides many beautiful species, a large number of insignificant weeds. This Sub-order is usually divided into two Tribes dependent upon the number of seeds in each cell of the fruit, viz., *Coffeæ* with seeds solitary in each cell, and *Cinchoneæ* with indefinite seeds.

LEAVES always opposite and simple, and almost invariably entire; with more or less conspicuous stipules inserted on each side of the stem between the pairs of petioles: in Sub-order Stellatæ, including the Bedstraws (*Galium*) and Madder (*Rubia*,) the leaves are whorled, apparently owing to the development of the stipules as leaves.

COROLLA rotate in Bedstraw (*Galium*); funnel-shaped in Woodruff (*Asperula*); narrowly tubular with a spreading limb (*hypocrateriform*) in Garden Ixora.

USES, &c.—Coffee is the dried seeds of *Coffea arabica*, probably indigenous in Tropical Africa, now cultivated extensively in Ceylon, Java, the West Indies and Tropical America; the principal British supply being derived from Ceylon. The valuable red dye Madder is the root of species of *Rubia* cultivated in France, the Levant and Northern India. The important tonic and febrifugal drug Quinine is prepared from the bark ("Peruvian bark") of species of *Cinchona* growing upon the slopes of the Andes in Peru and Ecuador. Of recent years some of the quinine-producing species have been introduced into India, where their cultivation is now successfully established. Ipecacuanha, celebrated as an emetic, is the root of a Brazilian shrub (*Cephaëlis Ipecacuanha*). Terra Japonica or Gambir, an astringent imported for the use of tanners, is prepared from the Indian *Uncaria Gambir*.

Cultivated in our hothouses for the sake of their ornamental flowers, are species of *Ixora*, *Gardenia*, *Pentas*, *Rondeletia*, *Burchellia*, *Manettia*, and several other tropical genera.

Natural Order

VALERIANACEÆ. Tab. 48.

DIAGNOSIS.—Herbs with opposite exstipulate leaves. Flowers cymose. Corolla epigynous. Stamens epipetalous, usually fewer than corolla-lobes. Seed solitary, pendulous, exalbuminous.

DISTRIBUTION.—A small Natural Order, widely dispersed, especially in the cooler regions of both Hemispheres. Many peculiar species occur at high elevations on the South American Andes.

NUMBER OF BRITISH GENERA, 2; Species, 5.

CALYX adherent, the limb reduced to minute teeth or obsolete; in Valerian (*Valeriana*) closely rolled up in flower, expanding in fruit as a feathery plume (*pappus*.)

COROLLA with a narrow spur at the base of the tube in Red Valerian (*Centranthus*;) with a lateral gibbosity in Valerian.

STAMENS 3 in Valerian, 1 in Red Valerian.

OVARY inferior, 1-celled, with more or less distinct indication of 2 suppressed cells.

USES, &c.—Lamb's Lettuce (*Valerianella Olitoria*) is grown for salad. The root of many of the perennial Valerianaceæ is stimulant and usually possesses a peculiar odour, especially developed in Spikenard (*Nardostachys Jatamansi*), a North Indian species, which has been valued from antiquity as a perfume.

Natural Order

DIPSACEÆ. Tab. 49.

DIAGNOSIS.—Herbs with opposite leaves. Flowers capitate. Corolla epigynous. Stamens epipetalous, usually 4. Seed solitary, pendulous, albuminous.

DISTRIBUTION.—A small Natural Order confined to the Old World, and most numerous in countries bordering the Mediterranean and at the Cape of Good Hope.

NUMBER OF BRITISH GENERA, 3; Species, 5.

LEAVES in Wild Teazle (*Dipsacus sylvestris*) broadly connate at the base.

FLOWER-HEADS in Teazle with projecting persistent bracts; in Fuller's Teazle (*D. fullonum*) recurved and elastic: flowers singly inclosed at the base in a cup-like involucel concealing and often closely investing the inferior ovary.

USES, &c.—The heads of Fuller's Teazle are used by woollen-cloth manufacturers to give a "nap" to their fabrics. *Scabiosa atropurpurea* is a common ornamental species of our open borders; it is naturalised in the South of Europe and is probably of Asiatic origin.

Natural Order

COMPOSITÆ. Tab. 50, 51, 52.

DIAGNOSIS.—Herbs or (in exotic genera) shrubs or trees. Flowers capitate. Corolla epigynous. Stamens 5 or 4, epipetalous; anthers syngenesious. Seed solitary, erect, exalbuminous.

DISTRIBUTION.—The largest Natural Order of flowering plants, reckoned to form about one-tenth of the whole; represented everywhere to the limits of Phanerogamic vegetation both in latitude and altitude. Although the Family is thus widely dispersed many of the Tribes are local and restricted to continents or narrower areas. The genera may be grouped under three Sub-Orders, viz.:—

I. TUBULIFLORÆ or CORYMBIFERÆ (Tab. 50.)—Corolla of all the flowers (*florets*), or of the central flowers only of the flower-heads, regular and tubular.

NUMBER OF BRITISH GENERA, 27; Species, 73.

II. LABIATIFLORÆ (Tab. 51).—Corolla of the central florets 2-lipped (chiefly South American).

III. LIGULIFLORÆ or CICHORACEÆ (Tab. 52).—Corolla of all the florets ligulate. (Juice milky.)

NUMBER OF BRITISH GENERA, 15; Species, 45.

INFLORESCENCE a flower-head (*capitulum*) bearing numerous small flowers (*florets*) closely crowded upon the receptacle; occasionally few-flowered (3–4) as in Garden Humea, rarely reduced to a single flower in exotic genera.

BRACTS surrounding the flower-head (*involucre*) usually herbaceous; in Everlastings (*Helichrysum*) and Garden Catananche dry scarious and coloured, persisting after the florets are fallen: bracts equal as in Daisy, or in 2 series, the outer recurved, as in Dandelion, or numerous and imbricating as in Knapweed and Bluebottle (*Centaurea*). FLOWER-HEADS consisting of tubular florets only as in Thistles (*Carduus*), or ligulate florets only as in Dandelion (*Taraxacum*), or tubular florets in the centre forming a *disk* and ligulate florets outside forming a *ray* as in Daisy (*Bellis*) and Sunflower (*Helianthus*); florets all hermaphrodite as in Dandelion, or those of the disk hermaphrodite and those of the ray pistillate as in Daisy, or the outer florets neuter as in Bluebottle (*Centaurea Cyanus*), or the florets of the disk staminate and those of the ray pistillate as in Marigold (*Calendula*), or flower-heads dicecious as in Mountain Everlasting (*Gnaphalium dioicum*) and Creeping Thistle (*Carduus arvensis*), or each floret tubular and inclosed in a separate involucel as in Echinops. FLORETS arranged upon a flat, convex or conical receptacle, with a chaffy scale subtending each floret as in Chamomile (*Anthemis*), or without scales (*naked receptacle*) as in Daisy and Dandelion.

ANTHERS cohering by their margins into a tube surrounding the style, with or without microscopic tail-like appendages at the base of each anther-cell.

STYLE slender, cylindrical, or, as in Bluebottle, slightly thickened under its branches with a minute hairy or papillose ring; STYLE-BRANCHES tapering to a fine point and studded over the entire surface with minute bristles as is characteristic of the exotic Tribe *Vernoniew*; or either club-shaped or cylindrical and blunt as in the Tribe *Eupatoriew*, chiefly exotic, represented in Britain by Hemp Agrimony (*Eupatorium*) and Coltsfoot (*Tussilago*); or more or less flattened and tapering at the tips as in the Tribe *Asterinew*, represented in Britain by Aster, Golden-rod (*Solidago*), and several other genera; or ending rather abruptly or in a minute cone at the tip, with papillæ or microscopic hairs, as in *Senecionidew*, of which numerous genera are British, as the Groundsels and Ragworts (*Senecio*) and Chamomile.

FRUIT a dry achene; naked as in Daisy and Ox-eye (*Chrysanthemum*); or crowned with the calyx-limb (*pappus*), which may consist of fine simple hairs as in Groundsel (*Senecio vulgaris*) and Garden Cineraria; or of

feathered hairs as in Plume Thistles (*Cnicus*); or of short stiff bristles as in Burdock (*Arctium*); or of 2 or 3 bristles only, rough with reflexed points, as in Bur-marigold (*Bidens*).

USES, &c.—Compositæ of the Sub-order Tubulifloræ generally abound in an aromatic and bitter principle, well exemplified in Wormwood (*Artemisia*) and Chamomile (*Anthemis*).

Ligulifloræ are characterised by a bitter, often narcotic, milky juice as in Dandelion and Lettuce (*Lactuca*).

Jerusalem Artichoke (*Helianthus tuberosus*), a species of Tropical American origin, is cultivated for its esculent tubers, which contain a substance chemically allied to starch (*inuline*) and sugar. Artichokes are the fleshy receptacle and surrounding scales of the large capitula of *Cynara Scolymus;* Cardoons, the blanched leaves of another South European plant of the same genus (*C. Cardunculus*), of which indeed the Artichoke may be but a cultivated variety. Chicory is the dried and roasted root of *Cichorium Intybus*, cultivated in Northern Europe to mix with or to substitute coffee. Dandelion-root (*Taraxacum officinale*) is a popular rustic medicine. Safflower, the dried flowers of *Carthamus tinctorius*, affords a good rose-coloured or orange dye.

To Tubulifloræ belong. of ornamental garden flowers, the Dahlia (*Dahlia variabilis*), introduced from Mexico, and Chrysanthemum (*Chrysanthemum indicum*), in both of which, under cultivation, the florets of the disk assume the form of those of the ray; Sunflower (*Helianthus annuus*), from America; several Senecios and "Cinerarias," the latter garden varieties of one or two species of Senecio introduced from the Canary Islands; Everlastings (*Helichrysum*), and the closely allied Cape *Aphelexis* of greenhouses, with rose-tipped involucral scales; Common Marigold (*Calendula*) of South Europe, and French and African Marigolds (Peruvian species of *Tagetes*); *Zinnia, Coreopsis, Aster,* Golden-rods (*Solidago*), *Humea, Ageratum,* several *Centaureas,* and many others.

Labiatifloræ include many very ornamental species, as *Barnadesia* and the *Mutisias*, occasionally seen in our plant-houses: but few are in general cultivation.

Ligulifloræ afford but few ornamental flowers. A large proportion bear yellow flower-heads, and these often close early in the day. *Catananche cærulea* of Southern Europe, with blue florets and silvery, dry, membranous, involucral scales, is one of the few species grown in our borders.

Natural Order

PRIMULACEÆ. Tab. 53.

DIAGNOSIS.—Herbs with radical or cauline leaves. Corolla hypogynous, usually regular. Stamens epipetalous, as many as corolla-lobes and opposite to them. Ovary 1-celled with free central placenta and numerous ovules. Style 1.

DISTRIBUTION.—A widely dispersed Natural Order, but most numerous in Europe and Temperate Asia, many species, especially of the principal genus Primula, affecting alpine situations.

NUMBER OF BRITISH GENERA, 8; Species, 16.

ROOT-STOCK large, fleshy and tuberous in Cyclamen.

LEAVES usually undivided or rarely dentate; in Water Violet (*Hottonia*) submerged and pinnatisect.

INFLORESCENCE various: in Cowslip (*Primula veris*) an umbel borne on an erect scape; in Primrose (*P. vulgaris*) the scape suppressed so that the pedicels are radical; in Chinese Primrose (*P. sinensis*) and Water Violet flowers whorled; racemose in Brookweed (*Samolus*).

COROLLA wanting, the calyx coloured, in Sea Milkwort (*Glaux maritima*).

OVARY half-inferior in Brookweed.

CAPSULE transversely dehiscent in Pimpernel (*Anagallis*).

SEEDS albuminous: one cotyledon suppressed in Cyclamen, the other occasionally persisting, and at length foliaceous.

USES, &c.—None of the species are of much economic importance, though many bear beautiful flowers and are in much request in ornamental gardening; as the numerous varieties of Primrose, Auricula and Polyanthus, belonging to the genus *Primula*, Loosestrife and Moneywort (*Lysimachia*), Cyclamens, American Cowslip (*Dodecatheon*), and others.

Natural Order

PLUMBAGINACEÆ. Tab. 54.

DIAGNOSIS.—Herbs, often woody below. Corolla hypogynous, regular. Stamens usually epipetalous, as many as corolla-lobes and opposite to them. Ovary 1-celled with 1 ovule suspended from a cord *(funicle)* rising from the base of the cavity. Styles 5.

DISTRIBUTION.—A small Natural Order represented in every quarter of the Globe; the two principal genera, *Armeria* and *Statice*, affecting either maritime or alpine situations. The genus *Plumbago* is chiefly Tropical.

NUMBER OF BRITISH GENERA, 2; Species, 6.

COROLLA divided very nearly or quite to the base in Thrift (*Armeria*) and Sea-Lavender (*Statice*).

USES, &c.—Unimportant, excepting for ornamental purposes. Species of Thrift and Sea-Lavender are cultivated in the open border, and in plant-houses exotic species of *Statice* and *Plumbago*.

MYRSINACEÆ is a small Natural Order, almost wholly Tropical, common to both Hemispheres, but without a European representative. The Order differs from Primulaceæ in habit rather than in any structural character. Nearly all the species are woody, either shrubs or arborescent.

A few ornamental species are cultivated in our plant-houses, chiefly belonging to the American genera *Clavija* and *Jacquinia* and to the East Indian *Ardisia*.

Natural Order

OLEACEÆ. Tab. 55.

DIAGNOSIS.—Trees or shrubs, sometimes climbing, with opposite leaves. Flowers regular, small. Corolla hypogynous; rarely polypetalous or wanting. Stamens 2, usually epipetalous.

DISTRIBUTION.—A rather small but cosmopolitan Natural Order. The genera are grouped under two Sub-orders, viz. :—

I. OLEINEÆ.—Corolla-lobes usually 4, valvate in bud.

II. JASMINEÆ.—Corolla usually salver-shaped, hypocrateriform, with 5 or more lobes, imbricate or twisted in bud.

NUMBER OF BRITISH GENERA, 2; Species, 2.

LEAVES simple as in Privet (*Ligustrum*) and Lilac (*Syringa*), or pinnate as in Ash (*Fraxinus*) and Garden Jessamine (*Jasminum*).

CALYX and COROLLA wanting and flowers polygamous in Common Ash (*Fraxinus excelsior*); calyx and corolla present in Flowering Ash (*F. Ornus*).

FRUIT a winged samara in Ash; a drupe in Olive (*Olea*); a capsule in Lilac.

USES, &c.—The wood of the Ash is very tough and elastic, and much employed by cartwrights and for structures exposed to much strain. Manna is the concrete saccharine juice exuded from incisions in the bark of two Mediterranean species of Ash (*Fraxinus Ornus* and *F. rotundifolia*). Olives are the drupaceous fruits of *Olea europæa*, cultivated from remote antiquity in South Europe and the Levant for the sake of the invaluable oil obtained from the pulp on pressure. The Lilac, numerous species of Jessamine, and the Chinese spring-flowering yellow *Forsythias* in general cultivation, belong to this Order.

Natural Order

GENTIANACEÆ. Tab. 56.

DIAGNOSIS.—Herbs with opposite entire exstipulate leaves, or aquatics with alternate leaves. Corolla hypogynous, regular. Stamens epipetalous, as many as corolla-lobes, and alternate with them. Ovary usually 1-celled, with numerous parietal ovules.

DISTRIBUTION.—A considerable Natural Order, widely distributed in both Hemispheres, but most abundant in cool regions either of latitude or altitude. Many species of the principal genus, Gentian *(Gentiana)*, are characteristic of alpine vegetation.

NUMBER OF BRITISH GENERA, 6: Species, 11.

LEAVES alternate and trifoliolate, from a creeping root-stock in Buckbean (*Menyanthes*); floating, resembling those of a small Water-lily, in *Limnanthemum*; opposite and connate in Yellow-wort (*Chlora perfoliata*).

COROLLA in Buckbean and Limnanthemum, both aquatic herbs, fringed more or less within.

USES, &c.—The species are almost invariably bitter, and several are employed in medicine as tonics; in Europe chiefly *Gentiana lutea*, common in alpine pastures. The flowers of Gentianaceæ are generally brilliant in colour, usually blue, yellow or red, and several are grown for ornament, as Gentianella (*Gentiana acaulis*) of the European Alps, in open borders and on rock-work, and a few exotic genera in plant-houses.

Natural Order

APOCYNACEÆ. Tab. 57.

DIAGNOSIS.—Usually climbing or trailing shrubs, with opposite entire leaves. Corolla hypogynous, regular. Stamens epipetalous, as many as corolla-lobes and alternate with them; pollen granular. Carpels 2, usually distinct in the ovary, united in the style and stigma.

DISTRIBUTION.—A large Natural Order, confined to Tropical and Subtropical regions, with but few outliers in cool countries.

ONE BRITISH GENUS; Species, 2 (introduced).

ANTHERS usually connivent around the stigma, 2-celled, frequently pointed or prolonged into an awn at the apex and sagittate at the base as in Oleander (*Nerium*).

STIGMA usually variously dilated; in Periwinkle (*Vinca*) annular, beneath an hour-glass constriction, crowned by a hairy tuft.

FRUIT either of 2 follicles as in Periwinkle, or berried or drupaceous in some exotic genera.

SEEDS of species with follicular fruits frequently bearing a crest of hairs (*comose*); in Periwinkle unappendaged.

USES, &c.—A large proportion of the species possess a milky juice which frequently contains caoutchouc, in a few cases in sufficient quantity to repay collecting. Many are poisonous or suspicious, although several species afford esteemed tropical fruits, and the milk-sap of a few is innocuous and used as food. *Tanghinia venenifera* of Madagascar is a virulent poison, and was formerly used in the island as an ordeal. The Oleander of our gardens

and parlours, of South European and Oriental origin, is another species of dangerous repute. Besides the two species of Periwinkle (*Vinca major* and *V. minor*) introduced from the Continent, and grown in every shady corner of our gardens, and Oleander (*Nerium*), several showy-flowered Apocyneæ are cultivated in plant-houses, as various garden varieties of Tropical American *Allamandas*, Indian *Beaumontia*, Chinese *Rhynchospermum* with jessamine-like flowers, the common white and rose-flowered *Vinca rosea* of the Tropics, and species of *Echites*, *Cerbera*, *Plumiera*, and a few other tropical genera.

Natural Order

ASCLEPIADACEÆ. Tab. 58.

DIAGNOSIS.—Usually woody or wiry climbers, with opposite entire leaves; sometimes succulent and leafless. Corolla hypogynous, regular. Stamens epipetalous, as many as corolla-lobes and alternate with them; united into a column around the stigma: pollen usually coherent in masses, and attached in pairs by a minute gland to the stigma. Carpels 2, distinct in the ovary, united above.

DISTRIBUTION.—Almost wholly Tropical and Subtropical, with many peculiar genera at the Cape of Good Hope; one of the principal of which, the Carrion-flowers (*Stapelia*), is remarkable in its leafless, tubercled, fleshy stems and livid flowers of ill-favoured smell. None occur in Britain.

COROLLA unappendaged within, or (and usually) with one row or more of distinct or united scales inserted around or upon the column of stamens.

POLLEN rarely granular; usually coherent in each cell of the anther into a waxy mass (*pollinium*); the pollen-masses of contiguous cells of adjacent anthers usually united by short stalks to a common gland applied upon the stigma; the pollen-masses are pendulous, horizontal, or erect in different sections of the Order.

FRUIT usually follicular, with comose seeds.

USES, &c.—The juice is usually milky and acrid, sometimes poisonous. Several species are employed medicinally in their respective countries. *Asclepias*, *Periploca græca*, the fleshy-leaved waxen-flowered Indian and Australian *Hoyas* of our plant-houses, *Stephanotus floribunda* of Madagascar, *Ceropegias*, and the remarkable succulent and leafless Carrion-flowers (*Stapelia*) of the Cape of Good Hope, are in cultivation.

Natural Order

CONVOLVULACEÆ. Tab. 59.

DIAGNOSIS.—Usually twining herbs with alternate leaves, or slender twining leafless parasites. Sepals 5, distinct. Corolla hypogynous, regular, twisted-plaited in bud. Stamens epipetalous, as many as corolla-lobes and alternate with them. Ovary 2-4-celled; ovules 1 or 2 in each cell.

DISTRIBUTION.—A numerous Natural Order, most abundant in Tropical and Subtropical regions of both Hemispheres, though with several species widely spread through the cooler zones.

NUMBER OF BRITISH GENERA, 2; Species, 5.

STEM rarely shrubby and erect in a few exotic species; in Dodder (*Cuscuta*) very slender, thread-like and twining, attaching itself to nurse-plants by numerous minute disks, each of which emits a root-fibre by which it absorbs nourishment from the nurse, and so is enabled early to become independent of the earth in which it originated on germination of the seed.

FLOWERS axillary, pedunculate; with a pair of leafy bracts immediately under and inclosing the calyx in White and Sea Bindweed (*Calystegia sepium* and *C. Soldanella*); in small sessile clusters in Dodder (*Cuscuta*).

EMBRYO, with folded cotyledons in a thin albumen; in Dodder spirally twisted within abundant albumen and destitute of cotyledons.

USES, &c.—Many Convolvulaceæ are characterised by a milky juice, and more or less of a resinous substance to which the medicinal value of some of the species is due. Two of the more important species in medicine are the Jalap-affording species of *Convolvulus*, indigenous in Mexico, and Scammony, the latter a Convolvulus (*C. Scammonia*) of the Levant. In the Batatas or Sweet Potato, the root of *Batatas edulis*, this resin is absent or inert, and the abundant farinaceous matter which it contains renders it a valuable article of food in tropical countries, where it substitutes the Potato cultivated in temperate regions. Most of the Convolvulaceæ bear very beautiful though short-lived flowers, and several are in general cultivation, as Major Convolvulus (*Pharbitis purpurea*), a common tropical weed; Minor Convolvulus (*Convolvulus tricolor*), introduced from Southern Europe; and, in plant-houses, several species of *Ipomœa*, *Batatas*, and *Argyreia*.

Natural Order

POLEMONIACEÆ. Tab. 60.

DIAGNOSIS.—Herbs with alternate or opposite leaves. Calyx 5-lobed. Corolla hypogynous, regular. Stamens epipetalous, as many as corolla-lobes and alternate with them. Ovary 3-celled; stigmas 3.

DISTRIBUTION.—A small Natural Order, chiefly confined to North America, with a few species in the cooler parts of Western South America, as well as in Europe and North Asia. The only British representative, Jacob's Ladder *(Polemonium cærulcum)*, is common to the Northern continents.

ONE BRITISH GENUS; Species, 1.

STEM erect; in *Cobæa* twining.

LEAVES undivided; or, in Jacob's Ladder or Greek Valerian, pinnately divided.

USES, &c.—The Order does not afford any important economic product. Many species are favourite garden flowers, as Jacob's Ladder, the numerous varieties of *Phlox*, and the pretty annuals *Gilia*, *Leptosiphon*, and *Collomia*. Cantuas and the twining Cobæa are grown in plant-houses. All of these are well marked by the association of a trimerous symmetry in the pistil with a regular gamopetalous corolla.

Natural Order

SOLANACEÆ. Tab 61.

DIAGNOSIS.—Herbs shrubs or small trees, usually with alternate leaves. Corolla hypogynous, regular or nearly so. Stamens epipetalous, as many as lobes of corolla and alternate with them. Ovary 2-celled, with numerous ovules. Seeds albuminous, usually with a curved embryo.

DISTRIBUTION.—A large Natural Order, by far most numerous in Equatorial regions of the Old and New World. Several genera, however, are represented both in the North and South Temperate zone, although no species attain high elevations or an Arctic latitude. The principal genus, *Solanum*, represented by 2 species in Britain, includes about 900 species, chiefly Tropical.

NUMBER OF BRITISH GENERA, 3; Species, 4.

LEAVES simple, very frequently arranged in pairs, (*geminate*), but not opposite; rarely pinnately divided as in Potato (*Solanum tuberosum*).

FLOWERS solitary or cymose; peduncles usually extra-axillary as in Bittersweet (*Solanum Dulcamara*).

CALYX enlarged after flowering and persistent (*marcescent*) in Winter Cherry (*Physalis Alkekengi*).

STAMENS dehiscing lengthwise, or in *Solanum* by terminal pores.

OVARY 2-celled; spuriously 4-celled in Thorn-apple (*Datura*), owing to the inflection of the dorsal suture of the carpels.

FRUIT various; a berry as in Bittersweet and Potato (*Solanum*), Deadly Nightshade (*Atropa*) and Tomato (*Lycopersicum*); a capsule dehiscing by valves as in Tobacco (*Nicotiana*) and Thorn-apple (*Datura*), or transversely by a lid as in Henbane (*Hyoscyamus*).

USES, &c.—Although Solanaceæ include several very important food-producing plants, yet generally the Order is narcotic and dangerous, and several species are notoriously poisonous. Of these, Deadly Nightshade (*Atropa Belladonna*), occasionally found in lanes and about ruins in England, the black and cherry-like berries of which are sometimes eaten by children, and Henbane (*Hyoscyamus niger*), a plant of neglected ground about villages, are amongst the more remarkable. Both are employed medicinally, as is the narcotic Stramonium or Thorn-apple (*Datura*). The principal food-plants of the Order are: Potato (*Solanum tuberosum*), probably of Peruvian or Chilian origin, now everywhere cultivated in temperate climates for the sake of its farinaceous tubers—the berries are dangerous; Tomato (*Lycopersicum esculentum*), of Tropical America; and the Aubergine (*Solanum Melongena*). Egg-apple (*S. oviferum*) and Winter Cherry (*Physalis Alkekengi*) afford fruits rendered harmless by cooking. Tobacco, as imported for smoking and the manufacture of snuff, consists of the leaves of two or three species of *Nicotiana*, dried by methods adapted to favour a fermentative process developing its peculiar narcotic principle. The species are probably of American origin, but now cultivated very widely in both Hemispheres; our chief supply being derived from the United States, Cuba, the Northern Provinces of South America, and Manila. It was first imported into Europe in the sixteenth century. *Nicotiana Tabacum* is the principal Tobacco-yielding species. Capsicums are the fruits of tropical species of *Capsicum*; the seeds are ground as Cayenne pepper, used as a pungent condiment.

Many Solanaceæ are very ornamental and frequent in cultivation, as *Petunias*, the large-flowered *Brugmansias* and *Daturas*, many species of *Solanum*, the shrubby *Lycium*s, often called Tea-plants, *Fabiana*, *Nierembergia*, *Nicotiana*, *Cestrum* and *Habrothamnus*.

Natural Order

GESNERACEÆ.

DIAGNOSIS.—Herbs usually with opposite leaves. Corolla hypogynous, irregular. Stamens epipetalous, fewer than corolla-lobes, usually didynamous. Ovary 1-celled, with parietal placentation and numerous ovules.

DISTRIBUTION.—A considerable Natural Order almost confined to hot countries, and most numerous in Intertropical America. But a solitary species occurs in Western Europe, confined to the Pyrenees *(Ramondia)*.

USES, &c.—Of no economic value, but many of the species are remarkably beautiful and found in every hot-house, as species of *Achimenes*, *Gloxinia*, *Tydæa*, *Gesneria*, *Columnea*, *Æschynanthus* and *Streptocarpus*. Some species of the last-named South African genus are remarkable in having one of the cotyledons persistent, enlarged, and at length foliaceous.

Natural Order

BORAGINACEÆ. Tab. 62.

DIAGNOSIS.—Herbs often hairy, with alternate simple leaves. Corolla hypogynous; regular or slightly irregular. Stamens epipetalous, as many as lobes of the corolla and alternate with them. Ovary 4-lobed, 4-celled, with 1 ovule in each cell. Style 1, usually gynobasic.

DISTRIBUTION.—A large and widely spread Natural Order, most numerous in Temperate climates, especially in countries bordering the Mediterranean and in Western Asia. The principal Tropical genera belong to a Sub-ordinal type characterised by more complete cohesion of the lobes of the ovary and a terminal style.

NUMBER OF BRITISH GENERA, 8; Species, 20.

INFLORESCENCE almost invariably a unilateral racemose cyme, as well shown in Forget-me-Not (*Myosotis*).

COROLLA usually regular, or the limb oblique in Viper's Bugloss (*Echium vulgare*); rotate in Forget-me-Not and Borage (*Borago*), or funnel-shaped in Comfrey (*Symphytum*); the throat naked in Bugloss, or with scales alternating with the stamens in Forget-me-Not and Comfrey.

OVARY 4-celled, owing to the infolding of the dorsal sutures of the 2 carpels composing the pistil.

FRUIT usually of 4 one-seeded indehiscent and separate nuts, which are frequently wrinkled, bordered, winged, or covered with hooked prickles; smooth, hard and porcelainous in Gromwell (*Lithospermum*).

USES, &c.—Many of the commoner species abound in mucilage or a harmless viscous juice, and are used in rustic medicine. The root frequently affords a red-brown dye turned to account by dyers in Alkanet (*Anchusa tinctoria*), cultivated in South Europe. The Forget-me-Nots (*Myosotis*), especially two or three species with flowers of brilliant blue, are frequent in gardens, as are also the spring-flowering *Omphalodes* and the fragrant Heliotrope (*Heliotropium peruvianum*); the latter introduced from Peru.

HYDROPHYLLACEÆ.—A small Natural Order, differing from Boraginaceæ in the one-celled ovary with parietal ovules, and in the leaves, which are commonly lobed or pinnatifid.

DISTRIBUTION.—Chiefly confined to North America. None are European.

USES, &c.—The Order contributes several pretty border annuals to our gardens, as *Nemophila*, *Eutoca*, *Whitlavia*, and *Phacelia*. *Wigandia*, cultivated for the sake of its noble foliage, is a near ally of this group, differing in the complete division of the ovary.

BIGNONIACEÆ.—Usually woody climbers, with opposite rarely simple leaves. Corolla showy, hypogynous, irregular. Stamens epipetalous, fewer than corolla-lobes, usually didynamous. Ovary 2-celled, or 1-celled with parietal placentation ; ovules numerous. Seeds commonly winged.

DISTRIBUTION.—A considerable, almost wholly Tropical, Natural Order; most numerous in the New World Many are *lianes* or rope-like climbers, attaining a great height in Brazilian forests, and forming a luxuriant crown of brilliant flowers and leafage on the tops of the trees.

USES, &c.—Unimportant, excepting as ornamental garden and plant-house climbers. The flowers are large and mostly brightly coloured, as in the Trumpet creepers (*Tecoma radicans* of the United States, *T. jasminoides* of Australia and others), *Bignonia*, *Jacaranda*, *Spathodea* and *Catalpa;* the last a hardy tree in the South of England, introduced from North America.

Natural Order

SCROPHULARIACEÆ. Tab. 63.

DIAGNOSIS.—Herbs, rarely shrubs, with alternate or opposite leaves. Corolla hypogynous, irregular. Stamens epipetalous, usually fewer than corolla-lobes, 4 and didynamous, or diandrous. Ovary 2-celled, with indefinite ovules. Seeds albuminous.

DISTRIBUTION.—A large Natural Order, very widely dispersed through both the Old and New World from the Equator to the limits of flowering vegetation; most numerous in Temperate and Sub-tropical regions. Several genera, both British and exotic, are partially parasitical by their roots upon neighbouring plants.

NUMBER OF BRITISH GENERA, 13; Species, 49.

FLOWERS usually irregular and bilabiate; personate in Snapdragon (*Antirrhinum*) and Toadflax (*Linaria*); spurred in Toadflax; nearly regular and rotate in Speedwell (*Veronica*) and Mullein (*Verbascum*); æstivation of the corolla-lobes imbricate; the upper lobe outside as in the Tribe Antirrhinideæ (Snapdragon, &c.), or inside as in the Tribe Rhinanthideæ (Yellow Rattle, &c.).

STAMENS rarely 5 as in Mullein; usually either 4 and didynamous as in Foxglove (*Digitalis*) and Monkey-flower (*Mimulus*); in Figwort (*Scrophularia*) with the fifth usually suppressed stamen partially developed; or stamens diandrous as in Speedwell (*Veronica*).

USES, &c.—A few species are used medicinally in their respective countries, but the Order generally is not of much economic importance. Foxglove (*Digitalis purpurea*), an indigenous species, is very poisonous and the most important of the medicinal species. Many are favourite garden flowers, as Calceolarias, of which numerous garden forms have originated through culture, introduced from Western South America; Snapdragon (*Antirrhinum majus*), indigenous in Southern Europe; North American *Pentstemons* and Monkey-flower (*Mimulus*); *Torenia*, *Collinsia*, the climbing *Lophospermum* and *Maurandya*, many Speedwells (*Veronica*), especially cultivated and hybrid forms derived from shrubby New Zealand species; Foxglove (*Digitalis*), one of our handsomest indigenous plants, and many others.

Natural Order

OROBANCHACEÆ.

DIAGNOSIS.—Herbs, destitute of green leaves, parasitical upon the roots of other plants. Corolla hypogynous, irregular, more or less 2-lipped. Stamens epipetalous, didynamous. Ovary 1-celled, with indefinite parietal ovules.

DISTRIBUTION.—A small Natural Order, widely dispersed in both Hemispheres; most numerous in the North Temperate zone of the Old World: very rare in South America, and represented by a solitary, perhaps introduced, species in Australia, which is also common to the Mediterranean region.

NUMBER OF BRITISH GENERA, 2; Species, 8.

STEM rarely branched, scaly, brown or purplish; pale in Toothwort (*Lathræa*).

USES, &c.—Some species have had medicinal properties ascribed to them, but none are of importance. The species generally affect special nurse-plants. The tallest British species, Great Broomrape (*Orobanche major*), is usually found upon Whin or Broom; the Red Broomrape (*O. rubra*) affects Thyme, and the Blue Broomrape (*O. cærulea*), Yarrow. Toothwort (*Lathræa squamaria*) usually grows upon the roots of the Hazel.

Natural Order

LENTIBULARIEÆ. Tab. 64.

DIAGNOSIS.—Herbs usually aquatic or of boggy ground, with radical, simple, or submerged and much dissected leaves. Corolla hypogynous, two-lipped. Stamens epipetalous, diandrous. Ovary 1-celled with free central placentation.

DISTRIBUTION.—A small Natural Order, dispersed over the Globe from the Equator to the cool Temperate zones and Arctic circle. In Brazil one large aquatic species grows in the water collected in the leaf-axils of a Tillandsia.

NUMBER OF BRITISH GENERA, 2; Species, 7.

LEAVES when submerged usually much divided and bearing little bladders, filled with air at the time of flowering, either scattered through the leaves or on distinct branches. The "bladders" may be regarded as specially modified leaf-segments.

CALYX 2-lobed as in Bladderwort (*Utricularia*), or 4-5-lobed as in Butterwort (*Pinguicula*).

OVARY with a central placenta, free from its origin, as in Primulaceæ; ovules indefinite.

USES, &c.—The species are of very small economic value, and are rarely seen in cultivation. Butterwort (*Pinguicula vulgaris*) is used by the Laplanders to give consistence to the milk of the Reindeer. Some exotic Bladderworts bear handsome purple or yellow flowers, and would form a valuable addition to our warm aquaria.

Natural Order

LABIATÆ. Tab. 65.

DIAGNOSIS.—Herbs, or more rarely shrubs, with 4-angled extremities and opposite leaves. Corolla hypogynous, usually more or less 2-lipped. Stamens epipetalous, fewer than corolla-lobes. Ovary 4-lobed, 4-celled, with one ovule in each cell. Style 1, gynobasic.

DISTRIBUTION.—A very large and cosmopolitan Natural Order, but especially characteristic, and relatively most numerous in genera, in countries bordering the Mediterranean, where Labiatæ count as one of the five or six largest Orders. But few grow in very cold climates.

NUMBER OF BRITISH GENERA, 18; Species, 46.

LEAVES usually dotted with minute immersed glands, containing volatile, often aromatic, oil.

FLOWERS usually collected in few-flowered cymes from the axils of opposite bracts or of the upper leaves when nearly sessile appearing as though verticillate.

COROLLA bilabiate; galeate as in Dead-Nettle (*Lamium*), or upper lip very short as in Bugle (*Ajuga*) and Germander (*Teucrium*): sometimes sub-regular, as in Mint (*Mentha*) and Marjoram (*Origanum*).

STAMENS 4, didynamous as in Dead-nettle, or equal as in Mint; or 2 as in Sage (*Salvia*) with very short filaments, and a long (distractile) connective separating the halves of each anther, of which one half is polleniferous and the other usually abortive and deformed.

FRUIT of 4 dry 1-seeded nuts.

USES, &c.—None of the Labiatæ are hurtful; nearly all are more or less aromatic, and many of them possess a bitter principle. These properties, variously proportioned, characterise a large number of species used as pot-herbs, condiments and perfumes, as Mint (*Mentha*), Penny-royal (*M. Pulegium*), Marjoram (*Origanum*), Sage (*Salvia*), Thyme (*Thymus*), Balm (*Melissa*), Basil (*Ocymum*), Savory (*Satureja*), Hyssop (*Hyssopus*), Lavender (*Lavendula*), and Rosemary (*Rosmarinus*). The powerful perfume Patchouli is the essential oil of the Indian *Pogostemon Patchouli*.

Many Labiates are cultivated for ornament, more especially Mexican species of *Salvia* with brilliant scarlet or blue flowers, of *Phlomis*, *Monarda*, *Leonotis*, and coloured-leaved varieties of *Perilla* and *Coleus*. Horehound (*Marrubium*), Sage (*Salvia officinalis*), and a few others are used in domestic medicine as stomachics.

Natural Order

VERBENACEÆ. Tab. 66.

DIAGNOSIS.—Herbs or exotic shrubs or trees, with opposite leaves. Corolla hypogynous, irregular. Stamens epipetalous, fewer than corolla-lobes, didynamous or diandrous. Ovary 4- or 2-celled, entire, with a terminal style.

DISTRIBUTION.—A considerable Natural Order, chiefly Tropical and Subtropical, with but four European representatives. The woody species are nearly all Tropical.

ONE BRITISH GENUS; Species, 1.

FLOWERS agreeing generally with those of Labiatæ, differing chiefly in the consolidated ovary.

USES, &c.—The most important member of the Order is the East Indian Teak-tree (*Tectona grandis*), affording an invaluable tenacious and very durable timber, used in building ships and railway-carriages. Several Verbenaceæ are in cultivation: everywhere garden varieties of Verbena, scarlet, purple, and white, originated by culture and hybridisation from two or three South American species; *Lippia citriodora*, for the sake of its fragrant foliage, and *Vitex Agnus-Castus*; while in our plant-houses, tropical species of *Clerodendron*, *Lantana*, *Petræa*, *Stachytarpheta*, and other genera with gay flowers.

Natural Order

ACANTHACEÆ.

DIAGNOSIS.—Herbs with opposite leaves. Corolla hypogynous, irregular. Stamens epipetalous, fewer than corolla-lobes. Ovary entire, 2-celled,

usually with 2 or more ovules in each cell. Fruit a 2-valved capsule, exposing the seeds supported upon hardened hooked or cup-like supports.

DISTRIBUTION.—A very large exotic Natural Order, almost wholly Tropical, with but few representative in Temperate regions. Acanthus is the only European genus. It is confined to the South-eastern portion of the Continent. To this Order belong many of the commonest Tropical weeds in both Hemispheres.

USES, &c.—Very few Acanthaceæ are of economic interest; some are used medicinally in their respective countries. In our plant-houses several freely-flowering ornamental genera are cultivated, as the twining *Thunbergias*, *Eranthemum*, *Justicia*, *Aphelandra*, *Ruellia* and others.

Natural Order

PLANTAGINACEÆ. Tab. 67.

DIAGNOSIS.—Herbs usually with radical leaves and spicate (or rarely solitary) inconspicuous flowers. Sepals 4. Corolla hypogynous, regular, scarious. Stamens epipetalous, as many as corolla-lobes and alternate with them. Ovary 2-4-celled.

DISTRIBUTION.—A small wide-spread Order, most numerous in the Temperate zone of the Old World.

FLOWERS perfect, in solitary terminal spikes in British species of Plantain (*Plantago*); unisexual and solitary or in pairs, the pistillate flowers sessile and destitute of a corolla in the aquatic Shoreweed (*Littorella*).

STAMENS with capillary exserted filaments and versatile anthers.

USES, &c.—The seeds of a few Indian species afford a copious mucilage, used medicinally and also to stiffen muslins. Ribwort or Ribgrass (*Plantago lanceolata*) is grown with various grasses for fodder.

DICOTYLEDONS WITH INCOMPLETE FLOWERS.

Natural Order

CHENOPODIACEÆ. Tab. 68.

DIAGNOSIS.—Herbs (or exotic under-shrubs) with alternate or opposite exstipulate leaves; sometimes succulent and leafless. Perianth small, herbaceous, regular. Stamens hypogynous or perigynous, as many as perianth-segments and opposite to them. Ovary free or partially adherent, 1-celled with one ovule. Embryo curved.

DISTRIBUTION.—A large and cosmopolitan Natural Order, especially affecting maritime or saline localities. A considerable section of the Order abounds in the salt plains of Temperate and Central Asia. A few species are everywhere weeds of cultivation.

NUMBER OF BRITISH GENERA, 6; Species, 24.

STEM fleshy, jointed and leafless in Glasswort (*Salicornia*), often sold as Samphire.

LEAVES various; fleshy in Sea Blite (*Suæda*); spine-pointed in Saltwort (*Salsola Kali*).

FLOWERS clustered with succulent adherent perianths, at length hard and inclosing the seed, in Beet (*Beta*); imbedded in 3's in the internodes in Glasswort; in Orache (*Atriplex*) unisexual or polygamous, the pistillate flowers inclosed between a pair of accrescent appressed bracts which replace the perianth.

STAMENS 1 or 2 in Glasswort.

SEEDS with or without mealy albumen; the embryo curved or spirally wound.

USES, &c.—None of the species are hurtful; several are familiar pot-herbs, and one South American species, Quinoa (*Chenopodium Quinoa*), affords in its copious seeds a valuable farinaceous food. The more important

species, besides Quinoa, are : Beet (*Beta maritima*), of which different varieties are cultivated for the table, for cattle-feeding (Mangold Wurzel), and, on the Continent, for the manufacture of sugar ; one ton of the root being reckoned to yield 100 lbs. of raw or 55 lbs. of refined sugar ; and Spinach (*Spinacia oleracea*), a common pot-herb, probably introduced originally from Western Asia. Species of Goosefoot (*Chenopodium*) and Orache (*Atriplex*) are sometimes used as substitutes for Spinach. Glasswort and Saltwort contain abundant alkaline salts, and carbonate of soda is extracted from their ash, called barilla. The seeds of the American *Chenopodium anthelminticum* have repute as a vermifuge, and one or two aromatic species are used in infusion as stomachics.

Natural Order

AMARANTACEÆ. Tab. 69.

DIAGNOSIS.—Usually herbs with alternate or opposite exstipulate leaves. Flowers small, surrounded by scarious bracts. Stamens hypogynous, 5 or fewer, free or united. Ovary free, 1-celled, with one or several ovules. Embryo vertical, curved around mealy albumen.

DISTRIBUTION.—A considerable Natural Order, chiefly confined to Tropical and Subtropical countries and Australia. None are indigenous in Britain.

USES, &c.—Nearly allied to Chenopodiaceæ, from which they are generally distinguishable at sight by their dry, scarious, often coloured bracts or bracteoles, which in a few species render the inflorescence very ornamental, as in Globe Amaranth (*Gomphrena globosa*) and its allies, Cockscomb (*Celosia cristata*), an abnormally fasciated condition of the species, Love-lies-bleeding and Prince's Feather (*Amarantus*). A South American *Iresine* is grown for the sake of its claret-red foliage : the majority of the species, however, are unattractive weeds. One or two species of *Amarantus* are cultivated in Northern India for their farinaceous seeds, and Blite (*Amarantus Blitum*) in South Europe is used as Spinach.

Natural Order

POLYGONACEÆ. Tab. 70.

DIAGNOSIS.—Herbs (or exotic shrubs) with alternate leaves and sheathing stipules. Perianth small, regular, often petaloid. Stamens 6-10. Ovary free, 1-celled, with 1 erect ovule, and 2-3 stigmas. Embryo straight or curved in mealy albumen.

DISTRIBUTION.—A rather large cosmopolitan Natural Order, ranging from the Equator to the extremes of flowering vegetation. The woody species are mostly Tropical.

NUMBER OF BRITISH GENERA, 3; Species, 27.

STIPULES almost invariably present and very characteristic, usually sheathing the stem as in Persicaria (*Polygonum*) and Dock (*Rumex*).

FLOWERS pentamerous, tetramerous, or in Dock (*Rumex*) and Rhubarb (*Rheum*) trimerous, the 3 inner segments of the perianth enlarging after flowering.

STAMENS in *Polygonum* usually not corresponding in number with the perianth-segments (*anisomerous*); in Dock 6, in Rhubarb 9.

USES, &c.—The valuable drug Rhubarb is the root of an Asiatic species of *Rheum* (*R. officinale*); Rhubarb of greengrocers, the acid leaf-stalks (*petioles*) of the large radical leaves of two or three species of the same genus. Sorrel (*Rumex scutatus*), with herbage similarly acid, is used as salad. Buckwheat (*Polygonum Fagopyrum* and *P. tataricum*) is largely cultivated, both in Europe and Asia, for its farinaceous seeds used in lieu of corn, and in Britain for feeding game and poultry. A few species of *Polygonum* are grown in gardens for ornament, as the tall shrubby *P. orientale* and the dwarf creeping *P. Brunonianum*, both of Asiatic origin.

Natural Order

THYMELACEÆ. Tab. 71.

DIAGNOSIS.—Usually shrubs, with tenacious bark and alternate exstipulate leaves. Flowers hermaphrodite. Perianth regular, gamophyllous. Stamens perigynous, definite. Ovary superior, 1-celled, with a solitary pendulous ovule.

DISTRIBUTION.—A considerable Natural Order, widely dispersed, but most numerous in peculiar forms at the Cape of Good Hope and in Australia.

ONE BRITISH GENUS; Species, 2.

STAMENS usually as many or twice as many as perianth-lobes.

SEED solitary, pendulous, exalbuminous.

USES, &c.—The tenacity of the inner layer of the bark (*liber*), characterising nearly all of the species of the Order, is turned to account in species of *Daphne* and *Edgeworthia* in the Himalaya and Eastern Asia, where it is used in paper-making. In the Lace-bark of the West Indies (*Lagetta*), the liber is separable into lace-like layers used in fabricating ornamental articles. The seeds of Daphne are acrid and often poisonous, as in Mezereon (*Daphne Mezereum*), a species with precocious purple or white flowers and scarlet berries common in gardens. Other Daphnes, as *D. Cneorum* and *D. Pontica*, and, in greenhouses, several Australian species of *Pimelea*, are frequently cultivated.

Natural Order

LAURACEÆ. Tab. 72.

DIAGNOSIS.—Trees or shrubs, usually aromatic, with entire, alternate or rarely opposite leaves. Flowers small. Perianth regular, gamophyllous. Stamens hypogynous or perigynous; anthers opening by recurved valves. Ovary free, 1-celled, with one pendulous ovule.

DISTRIBUTION.—A large Natural Order, chiefly confined to Tropical and Subtropical countries, though rare in Africa; extending into the cooler zones in Eastern Asia and North America. But one species, the Bay or Victor's Laurel (*Laurus nobilis*), is indigenous in Europe, where it is confined to the Mediterranean countries. Three or four species form an important feature in the forests of the Canary Islands and Madeira.

USES, &c.—The aromatic property characterising the Order is especially marked in Cinnamon (*Cinnamomum zeylanicum*) of Ceylon and one or two allied Indian species affording Cassia bark of commerce. Camphor is obtained by distillation from the wood of another species of the same genus (*C. Camphora*) indigenous in China and Japan. The wood is broken up, heated with water in closed vessels, and the volatile camphor sublimed. The wood and bark of the North American Sassafras (*Sassafras officinale*) are similarly aromatic and supply a sudorific medicine. The Avocado Pear (*Persea gratissima*) of South America is cultivated for the sake of its fruit in the West Indies and Atlantic Islands. Bay Laurel (*Laurus nobilis*) is common in English shrubberies, and a few tropical or Canarian species are cultivated for their fine usually evergreen foliage.

Natural Order

SANTALACEÆ. Tab. 73.

DIAGNOSIS. — Trees shrubs or herbs, with alternate simple leaves. Perianth small, regular, the lobes valvate in æstivation. Stamens epiphyllous, as many as lobes of perianth and opposite to them. Ovary inferior, 1-celled, with few ovules suspended from a central placenta.

DISTRIBUTION.—A small Natural Order, widely dispersed, especially in Temperate regions, in both Hemispheres. The European representatives are herbaceous or wiry perennials, and exhibit a partial subterranean parasitism.

ONE BRITISH GENUS; Species, 1.

USES, &c.—Sandal-wood, celebrated for its lasting fragrance, is obtained from species of the genus *Santalum*, growing in India and the Islands of the Pacific Ocean. The seeds of an Australian *Fusanus* are edible.

PROTEACEÆ is a large woody Natural Order of Dicotyledons with incomplete (monochlamydeous) flowers, characterised by coriaceous foliage, usually densely spicate or capitate flowers, stamens inserted upon and opposite to the valvate segments of the perianth, and ovary free, unilocular. The head-quarters of Proteaceæ is in Australia, where specimens of the Order form a large proportion of the scrub vegetation. It is numerous also at the Cape of Good Hope; elsewhere comparatively rare, and not represented in Europe. Species of *Banksia*, *Hakea*, *Grevillea* and *Protea* are in cultivation for the sake of their curious inflorescence and foliage.

Natural Order

ELÆAGNACEÆ. Tab. 74.

DIAGNOSIS.—Trees or shrubs with alternate simple leaves, more or less covered with minute scurfy scales. Perianth regular. Stamens epiphyllous, definite; if uniseriate alternate with the lobes of the perianth. Ovary free, 1-celled, with a solitary erect ovule.

DISTRIBUTION.—A small Natural Order, most numerous in the Himalaya and north-eastwards to Japan, with a few representatives in Northern Asia, Europe and America. Rare or wanting in Southern latitudes.

ONE BRITISH GENUS; Species, 1.

LEAVES and extremities clothed, at least at first, with disciform or stellate-peltate hairs, forming a silvery or rusty scurf.

FLOWERS diœcious in the only British species, Sea Buckthorn (*Hippophaë rhamnoides*): perianth-tube in its lower portion closely surrounding the ovary, persisting, and ultimately succulent, forming a spurious pericarp.

USES, &c.—The succulent investment of the fruit is edible in some species of *Elæagnus*, as in Trebizonde Dates (*E. orientalis*), and the North American Buffalo-berry (*Shepherdia*). A few species are frequent in shrubberies.

Natural Order

ARISTOLOCHIACEÆ. Tab. 75.

DIAGNOSIS.—Herbs or climbing shrubs with alternate leaves. Perianth epigynous. Stamens usually 6-12, epigynous or gynandrous. Ovary inferior, 3-6-celled.

DISTRIBUTION.—A small Natural Order, widely dispersed through warmer regions of both Hemispheres; most numerous in Tropical America. Several species are European.

NUMBER OF BRITISH GENERA, 2; Species, 2 (one introduced).

PERIANTH regular, with a three-lobed valvate limb in Asarabacca (*Asarum*), tubular, dilated around the stigma, and with the limb variously oblique in Birthworts (*Aristolochia*).

STAMENS epigynous, 12, free with distinct filaments, extrorse anthers and a subulate connective in Asarabacca; 6, gynandrous and wholly adnate to the column in Birthworts.

FRUIT a capsule, 6-valved in Birthworts.

USES, &c.—The root of two or three American species has a reputation as an antidote to the poison of snake-bites. Many species are stimulant and used medicinally in their respective countries. The North American *Aristolochia Sipho* is a common climber, with large cordiform leaves, cultivated in our gardens, and in hot-houses a few tropical species with large lurid perianths are met with.

NEPENTHACEÆ.—A very small exotic Natural Order, like Aristolochiaceæ without near affinity with any other known Order, characterised by climbing habit,, leaves bearing long prolongations of the midrib terminating in remarkable pitcher-shaped glands secreting fluid inside (hence the name Pitcher-plants applied to the group), and terminal racemes of unisexual flowers.

DISTRIBUTION.—Confined to South-Eastern Tropical Asia, the Indian Archipelago and Islands of the Indian Ocean, including Madagascar.

STEM remarkable in its internal anatomy from the extraordinary abundance of unrollable spiral vessels.

PERIANTH simple, 4-lobed.

USES, &c.—Pitcher-plants are of no economic importance. Several species, from the singularity of their pitchers, are frequently grown in hot-houses. In *Nepenthes Rajah*, a Bornean species not yet introduced, the pitcher is about 1 ft. in length by 6 in. in diameter, with a "lid" 10 in. by 8 in.

Natural Order

EUPHORBIACEÆ Tab. 76.

DIAGNOSIS.—Herbs shrubs or trees, often with a milky juice. Flowers unisexual, achlamydeous monochlamydeous or dichlamydeous. Ovary free, 3-celled, with 1 or 2 pendulous ovules in each cell; rarely 2-celled. Seeds albuminous.

DISTRIBUTION.—A very large and cosmopolitan Natural Order, most numerous in Tropical countries, where a large proportion of the species consists of trees or shrubs. The principal genus in Europe, Spurge *(Euphorbia)*, is common to every quarter of the Globe, and includes about 700 species. Some Tropical and Canarian Spurges assume the habit of Cactaceæ, with succulent, leafless, occasionally spinose stems.

NUMBER OF BRITISH GENERA, 3; Species, 16.

LEAVES usually membranous, alternate or opposite; in Box (*Buxus*) opposite, coriaceous and evergreen; in *Xylophylla* replaced by flattened leaf-like branches, bearing the flowers on their margin.

FLOWERS naked (achlamydeous) in Spurge (*Euphorbia*), inclosed in a minute cup-shaped involucre, usually one pistillate with several staminate flowers, the latter each reduced to a solitary stamen; the involucre bordered by 4 or 5 variously shaped, rounded or horned spreading lobes called "glands:" in Box (*Buxus*) flowers in axillary

sessile clusters, each with a simple 4-leaved perianth; several staminate flowers surrounding a central pistillate one: in Mercury (*Mercurialis*) with a simple (monochlamydeous) perianth: in Purging-Nut (*Jatropha Curcas*), and other exotic species, with distinct calyx and corolla (dichlamydeous).

OVARY almost invariably 3-celled; in Mercury 2-celled.

FRUIT separating when ripe from the persistent axis into its constituent carpels, which usually open elastically to liberate the seed; in Sandbox (*Hura crepitans*) with such force as to occasion a loud explosion.

SEEDS with copious fleshy albumen, solitary as in Spurge, or in pairs as in Box; embryo usually large, with flat leafy cotyledons exceeding the radicle as in Castor Oil (*Ricinus*).

USES, &c.—The milky juice characterising this Natural Order is usually associated with a volatile principle, more or less acrid, and often hurtful or poisonous, but generally dissipated by heat. The most important food-producing plants of the Order are the Tropical American species of *Manihot* (*M. utilissima* and *M. Aipi*), affording Cassava or Mandiocca meal and Tapioca. These farinaceous substances are obtained from the large fleshy roots; those of Bitter Cassava weighing from 30 to 40 lbs.: the venomous juice is expelled by pressure, washing and heat. Tapioca is the pure starch deposited by the water in which the cassava has been washed. This starchy matter is heated upon iron plates, and thus collects into the irregular small granular masses in which it is usually sold. The milky juice of species of *Siphonia* growing in Guiana and Brazil affords the best American caoutchouc. The juice is collected from wounds in the bark and allowed to dry in successive layers over moulds of clays, the clay being removed when the deposit is sufficiently thick and firm. Castor oil, obtained from the seeds of *Ricinus*, a native originally of India, but now everywhere between the Tropics; Croton oil, from the seeds of *Croton Tiglium*, another Indian plant, and the bark of *Croton Elutheria* of the West Indies, are the more important drugs afforded by the Order. A vegetable tallow is collected in China for candle-making from the surface of the seeds of *Stillingia sebifera*. To Euphorbiaceæ (?) we owe African Teak (*Oldfieldia africana*), a timber used in ship-building, and the hard dense wood of the Box (*Buxus sempervirens*), admirably adapted for the use of wood-engravers.

But few Euphorbiaceæ are cultivated in our gardens, the flowers usually being insignificant; in a few species of Spurge the glands of the involucre or the bracts assume a brilliant scarlet, as in *Euphorbia splendens* and *E. Bojeri*, of Madagascar, and *E. fulgens* and *E.* (*Poinsettia*) *pulcherrima*, of Mexico. *Codiæum variegatum* is grown in hot-houses for the sake of its beautifully variegated foliage, and a few species of *Phyllanthus* for their elegant habit. *Cælebogyne ilicifolia*, an Australian shrub with diœcious flowers, cultivated many years in European gardens, has acquired much notoriety from the circumstance that pistillate flowers only being borne by the cultivated plants, it nevertheless continues to afford mature seeds capable of germination.

Natural Order

ULMACEÆ. Tab. 77.

DIAGNOSIS.—Trees with watery sap and alternate distichous, penniveined, stipulate leaves. Flowers hermaphrodite or polygamous, with a bell-shaped perianth. Ovary free. Fruit dry and winged in the British species.

DISTRIBUTION.—A very small Natural Order of the North Temperate zone, common to both the New and Old World.

ONE BRITISH GENUS; Species, 2.

FRUIT in Elm (*Ulmus*) with a membranous wing (samaroid); in Planer-tree (*Planera*) a coriaceous nut.

USES, &c.—The Elms (*Ulmus campestris* and *U. montana*, the latter the Wych Elm) are noble and picturesque timber trees; common Elm often attaining 100 ft. or more in height. The wood is especially suited for works which are constantly under water, and that of knotted or pollard trees, owing to its hardness and intricate veining, is valued by cabinet-makers for ornamental work. The bark of some species, especially of the American Slippery Elm (*Ulmus fulva*), contains a very copious and wholesome mucilage.

Natural Order

PLATANACEÆ. Tab. 78.

DIAGNOSIS.—Trees with watery sap and alternate palmatifid, stipulate, deciduous leaves. Flowers naked, monœcious, in globose unisexual heads. Ovary 1-celled, with 1 pendulous ovule.

DISTRIBUTION.—Based upon the solitary genus Plane *(Platanus)*, which includes not more than four or five species; one of which is indigenous in the Levant, the rest in North America.

LEAVES with the petiole conically dilated and hollow at the base, concealing the axillary bud of next year's growth until its fall.

FLOWERS destitute of true perianth: the heads of male flowers consisting of a number of closely-packed subsessile anthers; the heads of female flowers, of club-shaped ovaries terminated by long persistent laterally stigmatose styles, intermixed with bristles and minute scales.

USES, &c.—The Eastern Plane (*Platanus orientalis*) and Western Plane (*P. occidentalis*) are valued as ornamental trees and much planted in the South of England. These species are very closely allied if not severed geographical races of one species.

Natural Order

URTICACEÆ. Tab. 79.

DIAGNOSIS.—Herbs (or exotic shrubs) with watery juice and opposite or alternate leaves. Flowers unisexual or polygamous. Stamens as many as perianth-segments and opposite to them. Ovary free, 1-celled, with 1 erect ovule.

DISTRIBUTION.—A considerable and widely-dispersed Natural Order, most numerous in genera and species in the Tropics, but, in individuals of two or three social species, abounding in temperate and cool regions. Common Stinging Nettle is one of the commonest weeds accompanying man in his migrations.

NUMBER OF BRITISH GENERA, 2; Species 4.

FLOWERS of Common Nettle (*Urtica dioica*) usually dicœcious, of Lesser Nettle (*U. urens*) monœcious, of Wall Pellitory (*Parietaria officinalis*) staminate, pistillate and hermaphrodite.

PERIANTH 4-leaved; or in the pistillate flower of Pellitory, gamophyllous and flask-shaped.

STAMENS incurved in bud, the filaments suddenly and elastically becoming recurved when the pollen is matured.

FRUIT a 1-seeded nut.

USES, &c.—Urticaceæ are generally characterised by a tenacious bark, which in some Asiatic species is used as cordage. The fibre of China-grass (*Boehmeria nivea*) is especially fine in texture, and is imported for textile purposes. Common Nettle, and some tropical species similarly clothed with stinging hairs, are applied externally as counter-irritants. The herbage of Nettle is occasionally cooked as a rustic substitute for Spinach.

Natural Order

CANNABINACEÆ. Tab. 80.

DIAGNOSIS.—Erect or twining herbs with watery juice. Flowers dicœcious. Stamens 5, opposite to the segments of the perianth. Ovary free, 1-celled, with 1 pendulous ovule. Seed exalbuminous, with a curved or spiral embryo.

DISTRIBUTION.—A very small Natural Order, or rather Tribe, of Urticaceæ, including but two species of distinct genera, widely spread through the North Temperate zone, where they are in general cultivation.

ONE BRITISH GENUS; Species, 1.

STEM erect and LEAVES digitate in Hemp (*Cannabis*); twining, and leaves simple, in Hop (*Humulus*).

BRACTS of the spicate pistillate flowers of Hop accrescent, loosely imbricating, forming a globose or ovoid head.

PERIANTH of staminate flowers regular, 5-phyllous; of pistillate flowers, reduced to a single enveloping scale.

EMBRYO of Hemp once-folded, of Hop spirally coiled.

USES, &c.—The bark of Hemp (*Cannabis sativa*) affords on maceration a fibre of great tenacity, which has been in use from remote antiquity in temperate countries for the fabrication of cordage and of strong coarse cloth. The same plant cultivated in a warmer climate develops a dangerously narcotic resin in the glands of the herbage, which is collected in India and Arabia as an intoxicant. The Hop, used in brewing, owes its value to a bitter aromatic narcotic gum-resin developed in the microscopic glands scattered over the surface of the enlarged bracts and nuts of the fruiting spikes.

Natural Order

MORACEÆ. Tab. 81.

DIAGNOSIS.—Usually trees or shrubs with milky juice and alternate stipulate leaves. Flowers unisexual. Stamens generally as many as lobes of the perianth (usually 4), and opposite to them. Ovary free, 1-2-celled; ovules variously inserted.

DISTRIBUTION.—Chiefly Tropical and Subtropical, although two or three of the species most important to mankind belong to the North Temperate zone, as the Fig (*Ficus Carica*), now cultivated

widely in South Europe and the Levant, probably a native originally of Western Asia, and the Mulberries *(Morus nigra* and *M. alba)*, also of Asiatic origin, now cultivated throughout Southern and Western Europe. The genus Fig *(Ficus)* is numerically by far the most important; the species are chiefly Tropical, often scandent, and freely throwing out adventitious roots, which clasp their support or become secured in the soil as in the Indian Banyan *(F. indica)*.

FLOWERS in Mulberry (*Morus*) collected in small dense unisexual spikes, usually monœcious, but the penultimate branches dicœcious; in Fig (*Ficus*) clothing the inside of a hollow fleshy receptacle (the "fig"); in *Dorstenia* immersed in a flat or concave open fleshy disk.

FRUIT collective or multiple: in Mulberry resulting from the flowers of one spike, the perianths of which have become succulent; in Fig, from the enlargement and succulence of the common hollow receptacle upon which the minute dry flowers are arranged.

USES, &c.—To a Tribe of this Natural Order belongs the Bread-fruit Tree (*Artocarpus incisa*) of Polynesia, the huge fruits of which, resulting from the consolidation of the fleshy carpels and receptacle, afford an abundant and wholesome food. The Jack of India (*A. integrifolia*) is a closely allied species, with a similar though less palatable fruit. Nearly allied in technical character to the Bread-fruits is the Upas of Java (*Antiaris toxicaria*), the resinous juice of which is a virulent poison, used by native tribes to tip their arrows. Another ally in Tropical America, the Cow-tree (*Galactodendron utile*), affords from incisions in the bark a very copious milky juice, which is quite wholesome and used as a substitute for milk.

Our supply of dried Figs, the fruit of *Ficus Carica*, is chiefly derived from Spain, Turkey, and Asia Minor. It is the most important of the few species of the vast genus *Ficus* bearing a succulent edible fruit. The light incorruptible wood of the Sycamore Fig (*F. Sycomorus*) of Egypt was used by the ancient Egyptians for mummy-cases. From *Ficus elastica*, often grown in parlours for the sake of its noble evergreen foliage, is obtained East Indian caoutchouc. Mulberry (*Morus nigra* and *alba*) owes its importance chiefly to its serving as the food of the silk-worm, for which purpose it (especially *M. alba* from Eastern Asia) is very largely cultivated in South Europe. Paper Mulberry (*Broussonetia papyrifera*) of Polynesia and Japan affords a tenacious liber, from which the Polynesians fabricate their Tapa cloth.

Natural Order

JUGLANDACEÆ. Tab. 82.

DIAGNOSIS.—Trees with alternate pinnate leaves. Flowers unisexual. Ovary inferior, 1-celled, with a solitary erect ovule. Seeds exalbuminous.

DISTRIBUTION.—A small exotic Natural Order of the North Temperate zone, with a few species penetrating the Tropics in the Old World. The principal genus, Walnut (*Juglans*), is common to both Hemispheres, though most numerous in America. No species is indigenous in Europe.

FLOWERS spicate; perianth of the staminate flowers scaly or rudimentary, of the pistillate flowers adherent to the ovary, with an obsolete limb surrounding 2 or 4 minute scales at the base of the short style.

FRUIT in Walnut drupaceous with a thin bony endocarp, from which vertical projecting plates partially divide the internal cavity and occasion the lobing of the seed.

USES, &c.—The Walnut (*Juglans regia*), introduced into Europe from the Transcaucasian provinces, is an important tree, much planted for shade and ornament. The wood is used in cabinet-work and for gun-stocks. From the kernels of its well-known shell-fruit an oil is expressed used as food. Hickory nuts of the United States are the fruits of species of *Carya* (*C. alba* and *C. tomentosa*). The North American Black Walnut (*Juglans nigra*) and Butternut (*J. cinerea*) afford valuable timber, the former especially adapted for ornamental and cabinet work.

Natural Order

MYRICACEÆ. Tab. 83.

DIAGNOSIS.—Aromatic shrubs with alternate resinous glandular leaves. Flowers spicate, unisexual. Perianth wanting in the staminate flower. Ovary free, 1-celled, with a solitary erect ovule.

DISTRIBUTION.—A very small but widely dispersed Natural Order. Several species occur at the Cape of Good Hope, in Temperate and Tropical America and India. The only British species, Sweet Gale *(Myrica Gale)*, grows in boggy moorland throughout the cooler parts of the North Temperate and Arctic zones.

ONE BRITISH GENUS; Species, 1.

USES, &c.—The small fruits of several species, but more especially of *M. cerifera* and *M. cordifolia* of North America and the Cape of Good Hope respectively, are covered with a waxy excretion, collected in small quantities as a substitute for tallow. The fruit of the Himalayan *M. sapida*, the size of a cherry, covered with closely-packed radiating cells filled with coloured agreeably acid juice, is edible.

Natural Order

CUPULIFERÆ. Tab. 84.

DIAGNOSIS.—Trees with alternate stipulate leaves. Flowers unisexual, the staminate in deciduous spikes or heads. Ovary inferior, with two or more cells. Fruit 1-celled, 1-seeded. Seeds exalbuminous.

DISTRIBUTION.—A Natural Order very numerous in species, though consisting of but few generic types; most abundant in the North Temperate zone and along the mountain chains of the Tropics, a few species extending into the South Temperate zone in South America. None occur in Tropical and Southern Africa.

The Order is conveniently divided into two Tribes, distinguished thus:—

I. QUERCINEÆ.—Staminate flowers with a distinct perianth. Ovules 2, in each cell of the ovary. Examples: Oak (*Quercus*), Chestnut (*Castanea*), Beech (*Fagus*).

NUMBER OF BRITISH GENERA 2; Species, 2.

II. CORYLACEÆ.—Staminate flowers destitute of a perianth. Ovary 2-celled, with one ovule in each cell. Examples: Hazel (*Corylus*), Hornbeam (*Carpinus*), Hop Hornbeam (*Ostrya*).

NUMBER OF BRITISH GENERA, 2; Species, 2.

I. QUERCINEÆ.

I. GENUS OAK (*Quercus*), including upwards of 250 species. Most numerous in species in Mexico, the United States, Asia Minor and the Levant, the Himalaya and Malayan Mountains, and in China and Japan. Common Oak (*Q. Robur*), the only species native in Britain, extends eastward through Europe to Central Asia.

DIAGNOSIS OF THE GENUS.—Involucre (cupule) sheathing a single nut. Staminate flowers in interrupted catkins. Ovary 3-celled.

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LEAVES deciduous or evergreen: falling in autumn as in Common Oak; persisting through the winter and falling on the expansion of the leaves in the succeeding spring as in Holm Oak (*Q. Ilex*) and Luccomb Oak, a hybrid derived from Turkey Oak (*Q. Cerris*). Many species, both American and Asiatic, are evergreen.

FLOWERS of Common Oak monœcious: staminate each with a simple perianth and 8 or more free stamens; pistillate usually 2 or 3 together, sessile or upon erect axillary peduncles, each flower surrounded by numerous minute coherent bracts; limb of the perianth reduced to microscopic teeth; ovary surmounted by a 3-lobed style.

FRUIT a nut (acorn), 1-celled, 1-seeded with traces of the suppressed cells and ovules on the inside of the pericarp. Embryo with a superior radicle and large fleshy plano-convex cotyledons. Acorn in Common Oak with the base sheathed by an involucre (cupule) consisting of numerous small, ovate, closely-imbricating, appressed, accrescent scales; in Turkey or Mossy-capped Oak (*Q. Cerris*) with the scales of the cupule subulate and recurved. Cupule various in other exotic species.

USES, &c.—As a timber tree the Oak is without rival in northern forests in the tenacity and durability of its wood, applied to almost every purpose of construction and application in the arts where these properties are required. The bark contains a large proportion of tannin and gallic acid, which render it a valuable astringent, generally employed as such by tanners. Galls upon the oak resulting from insect-punctures and the acorn-cups of some species, as of the Valonia Oak of the Levant (*Q. Ægilops*), partake of this property in a high degree, and the latter are largely imported for tanning and dyeing. It is owing to the presence of gallic acid in the wood that the timber of oak is so apt to acquire a black colour when immersed in bogs, from the natural ink resulting from the combination of the gallic acid of the wood with salts of iron contained in the water. The bark of Cork Oak (*Q. Suber*), growing in South-western Europe and Algeria, is separated artificially from the tree at intervals of 6–10 years after it attains an age of about 30 years; it is heated, flattened, and dried for exportation. Quercitron is the bark of *Q. tinctoria* of the United States, used as a yellow dye. Several North American Oaks, as the Red and Scarlet Oaks (*Q. rubra* and *Q. coccinea*), as well as the European Holm and Turkey Oaks, are frequently planted in England.

II.—GENUS CHESTNUT (*Castanea*).—Though not indigenous in Britain Spanish Chestnut

(*C. vesca*) is much planted for ornament in England, where it ripens its fruit in favourable seasons. It is the only Chestnut native in Europe, extending from Belgium and Portugal eastward to the Levant.

DIAGNOSIS OF THE GENUS.—Involucre (cupule) splitting into valves, usually wholly inclosing 3 or more nuts. Staminate flowers in erect axillary, interrupted spikes. Ovary usually 5-7-celled.

LEAVES deciduous, coarsely and acutely serrate.

FLOWERS of Spanish Chestnut monœcious: staminate with a simple perianth and 8-12 free stamens; pistillate in 3-4-flowered involucres, sessile near the base of the lower spikes bearing staminate flowers; each pistillate flower with the limb of the perianth reduced to minute teeth, a few minute rudimentary stamens (staminodes), and ovary surrounded by as many slender styles (5-7) as cells.

FRUIT in Spanish Chestnut a nut, usually three together in one coarsely-spinose involucre, opening when ripe in 4 valves. Embryo with large fleshy cotyledons more or less coherent by their waved inner faces.

USES, &c.—Spanish Chestnut is one of the noblest indigenous trees of Europe, occasionally attaining an enormous size; though from the reckless freedom with which the principal boughs are given off, and the great weight and resistance to the wind of the beautiful summer foliage, the older specimens are generally ruined by storms. The fruits (chestnuts) are collected for food. The wood is said to be brittle, and of no great value for purposes of construction.

III. GENUS BEECH (*Fagus*).—Including about twelve to fifteen species, of which but one is European. Several species abound along the South-Western coast of South America from Chili to Cape Horn, and four species are peculiar to New Zealand. Common Beech (*F. sylvatica*) is probably indigenous in Britain, where it is very extensively planted. It extends eastward through Europe as far as the borders of Asia.

DIAGNOSIS OF THE GENUS.—Involucre usually wholly inclosing 2 nuts, splitting into 4 valves. Staminate flowers capitate on pendulous axillary peduncles. Ovary 3-celled.

LEAVES of Common Beech deciduous or withering in autumn and falling in spring; in Copper Beech (*F. sylvatica, var. purpurea*), with the cells of the leaves containing a purple juice which disguises the green colouring matter.

FLOWERS monœcious; staminate with a simple lobed perianth and 8–12 free stamens; pistillate usually in pairs inclosed in a shortly pedunculate axillary involucre; styles 3.

FRUIT a triangular nut. Embryo with fleshy plicate cotyledons.

USES, &c.—The wood of Beech is very tenacious and elastic, valued for tools, shoe-lasts, and the like; used also for common furniture and for submerged piles. The nuts are collected as food for pigs, &c., and afford an oil used in France both as food and in lamps.

II. CORYLACEÆ.

IV. GENUS HAZEL *(Corylus).*—Including but few species, confined to the North Temperate zone, though common to both the Old and New World. Common Hazel (*C. Avellana*) is the only indigenous species in Britain; its range extends eastward to Central Asia.

DIAGNOSIS OF THE GENUS.—Fruit in heads of 2 or 3, each with an open involucre of herbaceous laciniate bracts. Staminate flowers in pendulous cylindrical catkins, borne in the axil of minute scales, each of 4 (or apparently 8) stamens, the filaments being forked and each division bearing half an anther.

FLOWERS in Hazel or Filbert developed in winter or early spring before the unfolding of the leaf-buds; the pistillate flowers recognised by their minute tufted crimson stigmas. The ovary at the time of flowering is undeveloped.

FRUIT in Hazel or Filbert a nut sheathed by the accrescent bracts of the involucre, with obscure traces of the minute limb of the perianth around the apex. Embryo with thick fleshy plano-convex cotyledons.

USES, &c.—Common Hazel is the parent form of the several varieties affording Filberts and Cob-nuts. The best British Filberts are grown in Kent; our foreign supply is chiefly from Spain. The flexible rod-like branches are used for hoops of casks, fishing-rods, and walking-sticks.

V. GENUS HORNBEAM (*Carpinus*).—Including very few species, confined to the North Temperate zone. Common Hornbean (*C. Betulus*) is probably indigenous in the eastern counties of England. It ranges south-eastward to the Caucasus.

DIAGNOSIS OF THE GENUS.—Fruits in loose pendulous catkins, singly subtended by 3-lobed open involucral bracts arranged in pairs in the axil of early deciduous scales. Staminate flowers in the axil of the minute scales of the catkins, of about 12 stamens with forked filaments. Fruit a small longitudinally-ribbed nut crowned by the toothed limb of the perianth, and sheathed by the accrescent leafy 3-lobed bract, the median lobe much longer than the lateral ones.

USES, &c.—Hornbeam is frequently planted as an ornamental tree. It is characterised by slender and graceful up-curved ultimate ramification. The wood is tough, and employed by wheelwrights.

VI. GENUS HOP-HORNBEAM (*Ostrya*).—Including but two species, one American, the other South European, extending into Asia Minor.

DIAGNOSIS OF THE GENUS.—Fruits in catkins, singly inclosed within an accrescent oblong involucral bract entirely closed excepting at the apex, arranged in pairs in the axil of early deciduous scales. Staminate flowers with distinct anther-cells as in Hornbeam. Fruit smooth.

FRUIT-CATKINS resembling fruiting heads of Common Hop (*Humulus*), whence the name (Hop-Hornbeam). The minute aperture at the apex of the loose hollow involucral bracts, the margins of which are connate, permits the exposure of the stigma during the flowering stage.

USES, &c.—The Hop-Hornbeam of Southern Europe (*Ostrya carpinifolia*) is a large spreading deciduous tree, occasionally planted in England. The wood of the American species is hard and very heavy. It is the Iron or Lever-wood of the United States.

Natural Order

BETULACEÆ. Tab. 85.

DIAGNOSIS. — Trees with alternate simple stipulate leaves. Flowers amentaceous, unisexual, monœcious; the pistillate flowers destitute of a perianth. Ovary 2-celled; styles 2. Fruit a small 1-seeded nut. Seed exalbuminous.

DISTRIBUTION.—A small Natural Order, consisting of but two genera (Birch and Alder), confined to the cooler regions of the Northern Hemisphere. The two British species of Birch have each a wide range through Northern Europe, Asia, and North America, while Alder extends eastward into Asia.

NUMBER OF BRITISH GENERA, 2; Species, 3.

FLOWERS of the staminate catkins in 3's, with a minute perianth of 4 scales inclosing 4 stamens in Alder (*Alnus*); the perianth reduced to a single scale subtending a pair of stamens in Birch (*Betula*): of the pistillate catkins in pairs, with 4 inner bracteole-scales and 1 outer bract-scale in Alder; in 3's in the axil of a 3-lobed scale in Birch.

FRUIT-CATKINS with the bract-scales at length woody and persistent in Alder, deciduous in Birch.

NUTS unappendaged in Alder; flat, and with lateral wings in Birch.

USES, &c.—The bark of Birch usually separates in papery or coriaceous laminæ from the trunk; in Paper Birch (*Betula papyracea*) of North America it is impermeable to water, and serves for the construction of light canoes and miscellaneous domestic and ornamental articles. The oil abounding in the bark of Common Birch is extracted for use in dressing Russia leather. The ascending sap in spring is more or less saccharine, and is collected from the cut extremities as an antiscorbutic beverage and for the preparation of Birch-wine. The wood of Birch is not very durable, though compact and easily worked. It is used in turnery. That of Alder is used in submerged constructions. Charcoal prepared from the Alder is employed in the manufacture of gunpowder.

Natural Order

SALICACEÆ. Tab. 86.

DIAGNOSIS.—Trees or shrubs with alternate simple leaves. Flowers amentaceous, unisexual, dicœcious, achlamydeous or with a rudimentary perianth. Ovary 1-celled, with several or numerous ovules on 2 parietal placentas.

DISTRIBUTION.—A Natural Order consisting of two genera, of which one (Willow) includes about 150 species widely distributed over the Globe, but by far most numerous in cool or Arctic climates.

NUMBER OF BRITISH GENERA, 2; Species, 32.

FLOWERS destitute of a perianth in Willow (*Salix*); with an oblique rudimentary perianth in Poplar (*Populus*).

STAMENS usually 2, 3 or 5 in Willow, 8–20–30 in Poplar.

FRUIT a small 2-valved capsule.

SEEDS minute, exalbuminous, with a basal tuft of silky hairs.

USES, &c.—The slender, pliable, annual shoots of several species of Willow (osiers) are used in basket-making. The light wood of the larger species affords a valuable charcoal. The bark of a few species, both of Willow and Poplar, has been employed medicinally.

Natural Order

CONIFERÆ. Tab. 87.

DIAGNOSIS.—Trees or shrubs, usually resinous, with scattered distichous or fascicled acicular or subulate leaves. Flowers unisexual. Ovules destitute of a closed carpellary covering, fertilised by direct contact of the pollen.

DISTRIBUTION.—A large Natural Order represented in every quarter of the Globe, though very rare in Tropical Africa, where, however, one of the most exceptional forms of the Order is found. Several genera, especially of the Southern Hemisphere, are local or peculiar to Southern latitudes, while the larger genera, Pine, Spruce, Silver Fir, Juniper and Cypress, are chiefly confined to the Northern Hemisphere in both the New and Old World. A few peculiar types are restricted to Eastern Asia and Japan. Some North American species, as Wellingtonia (*Sequoia gigantea*) and Douglas Fir (*Abies Douglasii*), attain upwards of 300 feet in height.

NUMBER OF BRITISH GENERA, 3; Species, 3.

LEAVES deciduous in Larch (*Larix*), persistent in most of the genera of the Order: singly scattered and distichous as in Yew (*Taxus*); in pairs as in Scotch Fir (*Pinus sylvestris*); in 3's as in Pitch Pine (*P. rigida*); in 5's as in Weymouth Pine (*P. Strobus*); whorled in Umbrella Pine (*Sciadopitys*); in many-leaved fascicles in Larch and Cedar (*Cedrus*); acicular as in Pines, or subulate as in Junipers (*Juniperus*), or scale-like and appressed as in Cypress (*Cupressus*), or broadly fan-shaped as in Maiden-hair Tree (*Salisburia*).

STAMENS with 2-celled subsessile anthers and a broad projecting connective, arranged in axillary spikes in Scotch Fir; with 3 or 4 cells on the lower margin of peltate scales arranged in short terminal spikes or heads in Cypress and Arbor-vitæ (*Thuja*); capitate, peltate, and usually 6-celled in Yew.

OVULES in pairs, inverted, at the base of concave, imbricating, spicate scales, inserted in the axil of small, often-concealed bracts in Pines: in pairs, erect, at the base of capitate scales in Arbor-vitæ, or similarly arranged but numerous in the axil of each scale in Cypress, or 3 at the base of as many connate scales in Juniper, or solitary and erect in Yew.

FRUIT *collective*; in cones with thickened, woody, persistent scales as in Scotch Fir, or thin persistent scales as in Larch and Spruce, or scales deciduous as in Silver Fir; or in globose heads of woody peltate scales as in Cypress; scales connate, at length fleshy and berry-like (*galbulus*) in Juniper: or fruit *simple*, sheathed by a succulent disk in Yew and Maiden-hair Tree.

SEED albuminous; winged in Pine.

EMBRYO frequently with numerous whorled cotyledons (or cotyledons 2, each deeply divided into several narrow segments) as in Pine and allied genera.

USES, &c.—Coniferæ owe their principal economic importance to the great number of valuable timber trees which the Order includes, and to their varied resinous products.

OF TIMBER TREES THE MORE IMPORTANT ARE:—Norway Spruce (*Abies excelsa*), affording the white deal, and Scotch Fir (*Pinus sylvestris*), the yellow deal of carpenters. Both species grow socially, forming immense forests in Northern Europe. Scotch Fir is the only Pine still indigenous in Britain. Silver Fir (*Picea pectinata*) of Central Europe. Weymouth Pine (*Pinus Strobus*) the White Pine of the United States, and Larch (*Larix europæa*) of Central Europe. The soft fragrant wood of a North American Juniper (*Juniperus virginiana*) is used, under the name of Cedar, in pencil-making and the lining of cabinet-work. The wood of true Cedar (*Cedrus Libani*) is difficult to obtain in quantity, and of little present importance for purposes of construction, though formerly, when the tree had a wider range in Northern Syria, it would appear to have been in great request. The timber of the Himalayan Deodar (a variety of the Cedar), like that of Cypress, is said to be exceedingly durable. The wood of Yew was formerly in great request for bows.

Of Resinous Products Afforded by Coniferæ we have:—Tar, obtained chiefly in the Baltic provinces of Europe by dry distillation from the wood of Scotch Fir. Turpentine, collected as an exudation from wounds made in the trunk of *Pinus palustris* in the United States. Common rosin, the residuum after distillation of oil of turpentine. Venice turpentine, obtained from the Larch; Strasbourg turpentine from the Silver Fir; Canada balsam from blisters in the bark of *Abies balsamea* and *A. Fraseri* of North America; Burgundy pitch from the Spruce Fir; Dammar or Kauri resin from *Dammara australis* of New Zealand.

The seeds of Stone Pine (*Pinus Pinea*) of South Europe, *P. Cembra* in Northern Asia, and Maiden-hair Tree in Japan, are edible; as are those of the Bunya-Bunya (*Araucaria Bidwillii*) of Australia, used as food by the aborigines.

Juniper-berries, the fruit of Common Juniper, are used in the manufacture of gin: the allied Savin (*Juniperus Sabina*), characterised by the peculiar odour of its volatile oil, is medicinal.

Agreeing with Coniferæ in the remarkable and very exceptional character of gymnospermy, that is in having the ovules borne upon an open scale and fertilised by direct contact of the pollen, is the small exotic Natural Order Cycadeæ. The species of this group resemble the pinnate-leaved palms in habit, the trunk being usually unbranched and terminating in a crown of pinnate, often rigid or spinose fronds. From the trunk of a few species a coarse sago is obtained, and from the nuts of *Cycas circinalis* a similar farina, much used by the poorer natives in Ceylon and Western India. Most of the species are natives of Mexico, the Cape of Good Hope and Tropical Asia. None are now indigenous in Europe, though their fossil remains occur in the South of England in the lower greensand.

MONOCOTYLEDONS WITH PETALOID FLOWERS.

Natural Order

PALMACEÆ. Tab. 88.

DIAGNOSIS.—Usually trees with unbranched trunks bearing a terminal crown of large pinnate or palmate leaves. Flowers small, often very numerous, upon a spadix; perfect or unisexual, with a 6-leaved perianth. Ovary superior of three free or coherent carpels; ovules usually solitary in each cell.

DISTRIBUTION.—A large and majestic group, almost peculiar to Tropical and Subtropical countries of both Hemispheres. A few species penetrate northwards in Eastern Asia as far as Japan, in North America to the United States, and a solitary species reaches Southern Europe. In the Southern Hemisphere a few members of the Order occur in Extra-tropical America and in Australia.

TRUNK usually erect, occasionally wanting; prostrate on the ground as in Vegetable Ivory Palm (*Phytelephas*), or climbing and rope-like, often 1,000 ft. or more in length, as in Rattan Palms (*Calamus*).

LEAVES pinnate as in Date (*Phœnix*) and Cocoa-Nut (*Cocos*), fan-like (palmate) as in Palmyra (*Borassus*) and the European Fan-Palm (*Chamærops*); leaflets wedge-shaped in Wine Palm (*Caryota*.)

FRUIT extremely variable in respect of the pericarp: apocarpous, one carpel only usually maturing, with a succulent pericarp in Date; or syncarpous, with 2 cells of the ovary suppressed: a thick fibrous outer pericarp (the husk) and bony endocarp (the shell) in Cocoa-nut.

SEED with abundant albumen; fleshy in Cocoa-Nut, horny in Date, or hard and bony in Vegetable Ivory.

USES, &c.—Palmaceæ furnish in tropical countries besides daily food, habitation, clothing, and domestic utensils to a large proportion of the inhabitants. A few of the important economic species are:—

Cocoa-Nut (*Cocos nucifera*), one of the most widely-diffused species of the Order, though chiefly restricted to tropical shores and rarely found far inland. It affords in its fruit, besides the valuable nut with its fleshy albumen and inclosed "milk," a fibre, forming the outer pericarp, used for cordage, brushes and mats, imported under the name of "coir." The sap collected from incisions in the flowering branches is a grateful beverage, "toddy," from which arrack is distilled. The oil expressed from the albumen of the nut is used in soap- and candle-making; 7 or 8 nuts yielding about one quart. The terminal leaf-bud, as in American species of Areca, Sabal and other Palms, is cooked as "cabbage." The hard wood (porcupine wood) is employed in building, and the leaves as thatch.

Date Palm (*Phœnix dactylifera*), indigenous in Northern Africa and supplying to the desert tribes their more important wants. The saccharine fleshy pericarp is the common food of themselves and of their cattle. It has been introduced into Southern Europe, but North of the Mediterranean it rarely perfects its fruit: the leaves are used in festivals of the Roman Catholic Church.

Oil Palm (*Elæis guineensis*) of Tropical Africa. From the small densely-clustered nuts, Palm oil, largely used in the manufacture of soap and candles, is obtained by boiling.

Sagus Rumphii and allied species of the Indian Archipelago, *Arenga saccharifera* also of the Indian islands, and a few other species, contain in the cellular tissue of the central portion of the trunk an abundant farina, which is collected from felled trees, granulated artificially, and imported as sago. From the fibre of the leaves of the Ruffia Palm (*Raphia Ruffia*) the inhabitants of Madagascar fabricate the cloth commonly used for their clothing,

Palmyra Palm (*Borassus flabelliformis*) of India is one of several species besides the Cocoa-Nut from which a vinous sap is collected. Boiled down it affords "jaggery," or palm-sugar.

The Piassaba Palms (*Leopoldinia Piassaba* and *Attalea funifera*) of Tropical America yield a useful fibre derived from the leaf-stalks, imported as Piassaba fibre for cordage and street-brooms. The bony pericarp of the *Attalea* is used in turnery-work, as is the hard white albumen of the Vegetable Ivory Palm (*Phytelephas macrocarpa*), a stemless or rather prostrate ally of the true Palms growing in the Isthmus of Panama and New Grenada.

The long flexible stems of scandent species of *Calamus* in Malacca and the Indian Archipelago are imported as Rattans, used in caning chairs, broom-making, &c.

The astringent nuts of *Areca Catechu* are gathered in enormous quantities in Tropical Asia to chew with lime and the leaves of a species of pepper.

Natural Order

AROIDEÆ. Tab. 89.

DIAGNOSIS.—Herbs or, in tropical species, often shrubby climbers, with frequently net-veined leaves. Flowers small, sessile, upon a simple spadix, naked or with a scaly perianth, unisexual or bisexual. Ovary free, with one or more cells.

DISTRIBUTION.—A large Natural Order, chiefly confined to humid Tropical and Subtropical countries. A few herbaceous genera with radical leaves are represented in Europe, one genus extending northward into Scandinavia. The only two British species belong to distinct genera, representing each of the two Sub-orders into which Aroideæ are sometimes divided, viz.:—

I. ARACEÆ.—Flowers usually unisexual, destitute of a perianth.

II. ORONTIEÆ.—Flowers usually perfect, with or without a scaly perianth.

NUMBER OF BRITISH GENERA, 2; Species, 3.

LEAVES petiolate, hastate and net-veined in Cuckoo-pint (*Arum maculatum*); narrow, sword-like and parallel-veined in Sweet Flag (*Acorus*).

SPATHE ample, convolute, sheathing the spadix in Cuckoo-pint: phyllodineous, forming an apparent direct continuation of the peduncle from the base of the spadix in Sweet Flag.

SPADIX in Arum bearing a ring of naked, closely-packed pistillate flowers and a few imperfect carpels at the base, at a short interval above a ring of sessile anthers and a few staminodes, and terminating in a club-shaped sterile appendix: in Sweet Flag densely covered throughout with numerous hermaphrodite flowers, each with a 2-3-celled ovary, 6 stamens and 6 perianthial scales.

FRUIT usually a berry.

USES, &c.—Aroideæ are generally characterised by acridity of their juices, very marked in Cuckoo-pint, especially in the corm, and yet more strongly in Dumb-cane (*Dieffenbachia Seguine*) of the West Indies, the juice of which occasions violent inflammation of the membrane of the throat and mouth, and swelling of the tongue. This acridity is dissipated by heat or boiling, and, in the case of the corms of Cuckoo-pint, leaves behind an abundant farina, which was formerly collected in the Isle of Portland as British arrowroot. The large farinaceous tubers of *Colocasia antiquorum* and allied species form an important article of food in the tropics, where they are much cultivated. The rhizome of Sweet Flag is a well-known aromatic bitter.

Several stemless and scandent tropical Aroids are grown in our hot-houses, as numerous varieties of *Caladium*, remarkable for the beautiful variegation of their hastate leaves; *Colocasia; Alocasia*, the leaves of which sometimes present an almost metallic lustre; *Philodendron; Anthurium; Monstera*, the axis of the fruit-spike of which is edible; and the so-called Lily-of-the-Nile or Arum, a South African species of *Richardia*, with a beautiful white funnel-shaped spathe.

Natural Order

LEMNACEÆ. Tab. 90.

DIAGNOSIS.—Herbs, reduced to minute oblong or ovate disk-like fronds floating upon stagnant water. Flowers from a fissure in the margin or upper surface of the frond; in the common British species consisting of 2 stamens and a 1-celled ovary sheathed by a membranous spathe.

DISTRIBUTION.—A very small Natural Order, nearly allied to Aroids, common in stagnant pools throughout the Temperate zones; less frequent between the Tropics.

ONE BRITISH GENUS; Species, 5.

ROOTS consisting of simple fibres from the under surface of the frond, each sheathed at the extremity by a conspicuous sheath (*coleorrhiza*).

FLOWERS very minute, rarely seen excepting in *Lemna minor: L. polyrrhiza*, with tufted root fibrils, has not been observed in flower in Britain.

USES, &c.—The Order is of no economic importance. Its chief interest consists in the remarkably reduced character of its vegetative system.

Natural Order

NAIADEÆ.

DIAGNOSIS.—Aquatic marine or freshwater herbs, with floating or submerged stipulate leaves. Flowers small, perfect or unisexual. Perianth of 4 minute segments or wanting. Stamens 1-4. Pistil apocarpous, of 1-4 carpels. Seed exalbuminous.

DISTRIBUTION.—A small Natural Order, but, as is usually the case with aquatic groups, widely dispersed over the Globe. Most of the species of Pondweed *(Potamogeton)* are found in fresh water, but a few species of this genus, and all the other British genera, occur in brackish or salt water.

NUMBER OF BRITISH GENERA, 5; Species, 18.

LEAVES various: when floating, as in some of the Pondweeds (*P. natans* and allies), usually elliptical or oblong; when submerged, with few exceptions, narrow, linear, or even capillary; very rarely opposite as in *P. densus:* in Grasswrack (*Zostera marina*) rooting in sand near low water-mark, narrow-linear from a few inches to several feet in length.

INFLORESCENCE a pedunculate spike as in Pondweed; or axillary and sessile as in Horned Pondweed (*Zannichellia*); or inclosed within a narrow sheath near the base of the leaves in Grasswrack.

STAMENS various; pollen in Grasswrack narrow-linear, with but a single membranous coat.

USES, &c.—Grasswrack (*Zostera marina*), common on sandy shores of Britain, is collected and dried for use in packing goods and stuffing mattresses. The Lattice-leaf (*Ouvirandra*) of Madagascar, a near ally of this Order, remarkable in its perforated lace-like leaves, is occasionally cultivated in warm tanks. Several British species are suited for parlour cultivation in aquaria.

Natural Order

ALISMACEÆ. Tab. 91.

DIAGNOSIS.—Herbs, growing in water or in wet places, with radical leaves. Flowers with a 6-leaved perianth; usually perfect. Stamens hypogynous. Pistil apocarpous, or carpels at length separating. Seed exalbuminous.

DISTRIBUTION.—A small Natural Order, generally dispersed in the four quarters of the Globe.

NUMBER OF BRITISH GENERA, 6; Species, 9.

PERIANTH usually with the inner whorl coloured; the outer in Water Plantain (*Alisma Plantago*) sepaloid.

STAMENS as many as perianth-leaves in Water-Plaintain, or 9 in Flowering Rush (*Butomus*).

SEEDS solitary in each carpel in Water-Plantain, indefinite and scattered over the walls of the ovary in Flowering Rush.

USES, &c.—None of the species are of much importance to mankind. Flowering Rush is an ornamental aquatic, occasionally planted on the margin of ponds. The rhizomes of some Asiatic species of *Sagittaria* afford a farinaceous food.

Natural Order

TYPHACEÆ.

DIAGNOSIS.—Herbs, growing in wet places, with long, narrow, erect leaves. Flowers monœcious, naked or with a scaly perianth, in dense spikes or globose heads. Fruit dry, 1-seeded. Seed albuminous.

DISTRIBUTION.—A Natural Order of but two small genera, of which one, Bulrush (*Typha*), is widely scattered over the Globe; the other, Bur-reed (*Sparganium*), is chiefly confined to the cooler regions of the North Temperate zone.

NUMBER OF BRITISH GENERA, 2; Species, 5.

FLOWERS in Bulrush in a very dense cylindrical spike; the staminate flowers above, the pistillate below; continuous with each other in Great Bulrush (*T. latifolia*), separated by a short interval in Lesser Bulrush (*T. angustifolia*): the pistillate flowers with numerous hair-like filaments from the stalk of the ovary: flowers of Bur-reed in globose heads, the upper consisting of numerous stamens intermixed with minute scales; the lower of crowded ovaries with rudimentary scaly perianths.

USES, &c.—The rhizome of *Typha* contains a coarse astringent farina, collected in Asia for medicinal purposes and also as food. The pollen is occasionally gathered and made up into cakes, which are eaten in India and New Zealand.

Natural Order

HYDROCHARIDACEÆ. Tab. 92.

DIAGNOSIS.—Aquatic herbs, with radical or cauline leaves. Flowers usually diœcious, with a 3-6-leaved perianth. Ovary inferior. Seeds indefinite, exalbuminous.

DISTRIBUTION.—A small Natural Order, generally distributed over the Globe.

NUMBER OF BRITISH GENERA, 3; Species, 3 (one introduced).

STEM submerged, slender, branched and leafy throughout in Water Thyme (*Elodea canadensis*); a floating rhizome with tufted orbicular leaves in Frog-bit (*Hydrocharis*); rhizomatous at the bottom of the water, with long narrow leaves, in Water Soldier (*Stratiotes*) and *Vallisneria*.

FLOWERS inconspicuous in Water Thyme, the pistillate only recognised as yet in Britain, sessile in the upper axils; in Frog-bit conspicuous with petaloid inner perianth-leaves and pedunculate; in *Vallisneria* the small pistillate flowers solitary on long slender peduncles reaching to the surface of the water; staminate flowers in subsessile submerged heads, which become detached and rise to the surface to discharge their pollen. After fertilisation the spiral peduncles of the pistillate flowers are withdrawn under the surface and mature their seeds at the bottom.

USES, &c.—But few species possess economic importance. Species of *Hydrilla* and some of the Naiadeæ are used in India in "claying" sugar. *Vallisneria*, introduced from Southern Europe, is everywhere cultivated in aquaria, for which its bright green colour, easy propagation and persistent vitality well fit it. Thin longitudinal slices of the leaves are suitable for exhibiting under the microscope the motion of the cell-contents, as are the membranous scales at the base of the petioles of Frog-bit. Water Thyme, a North American aquatic, was first noticed in Britain about the year 1847, since which time it has spread rapidly, in some localities to such an excess as to obstruct the navigation of slow streams and canals.

Natural Order

ORCHIDACEÆ. Tab. 93.

DIAGNOSIS.—Herbs with sheathing leaves. Flowers irregular. Stamens 1 or 2, adnate to the style. Ovary inferior. Seeds indefinite, exalbuminous, without distinction of radicle and cotyledon.

DISTRIBUTION.—A very large Natural Order, widely distributed both in Temperate and Tropical countries; in the former the species are usually rooted in the earth (*terrestrial*), while in hot humid climates a large proportion of the species are *epiphytal*, growing upon the bark of trees, though without deriving nourishment from their juices as do parasites.

NUMBER OF BRITISH GENERA, 17: Species, 36.

STEM in British Orchids erect, simple, succulent; in many tropical epiphytal species variously thickened, forming *pseudo-bulbs*.

LEAVES sheathing, membranous, succulent or coriaceous, usually entire and glabrous; wanting (reduced to coloured scales) as in Coral-root (*Corallorhiza*) and Bird's-nest (*Neottia*), British species growing amongst decomposing vegetable matter.

FLOWERS bracteate, racemose or spicate in nearly all British genera; panicled or solitary in some exotic genera; usually inverted (*resupinate*) so that the uppermost (posterior) leaf of the perianth becomes apparently the lowest (anterior) by the partial twisting of the ovary or pedicel.

PERIANTH-LIMB of 6 segments, 3 outer (sepals) and 3 inner (petals); the median lower petal (lip or labellum) almost invariably different in form from the rest and usually larger; in Common Orchis with the base (attached end) of the lip prolonged into a spur.

STAMEN consolidated with a continuation of the pistil above the sessile stigma forming a "column" opposite to the lip. POLLEN various, powdery or coherent in waxy or granular masses: when coherent (forming pollinia) with or without a disk-like appendage (gland) united to the pollinia by a slender pedicel (*caudicle*). Upon characters derived from the structure of the column and of the pollen Orchidaceæ are divided into tribes, of which the more important are:—

* ANTHER ONE.

1. MALAXIDEÆ.—Pollen coherent in waxy masses, unappendaged; as in the British genera *Liparis* and *Malaxis* and the Tropical Asiatic genus *Dendrobium* cultivated in plant-houses.

2. EPIDENDREÆ.—Pollen coherent, provided with a caudicle but destitute of a distinct gland. There is no European representative of this group. *Cattleya* and *Epidendrum* of plant-houses are examples.

3. VANDEÆ.—Pollen coherent, provided with a distinct gland, to which it is usually connected by a caudicle. Nearly all tropical; none European. Examples: *Catasetum, Vanda, Oncidium, Saccolabium* of plant-houses.

4. OPHRYDEÆ.—Anther erect. Pollen consisting of numerous minute granular segments united into 2 pollinia by concealed elastic threads, which are continued in each pollen-mass into a caudicle terminating in a gland, or (as in Pyramidal Orchis) both caudicles united to the same gland. To this Tribe belong the British genera *Orchis, Habenaria* (including the Butterfly and Frog Orchis) and *Ophrys* (including the Fly and Spider Orchis).

5. NEOTTEÆ.—Anther erect or resting obliquely upon the back of the column. Pollen granular, loosely coherent, destitute of caudicle or gland in British genera, but with the anterior end of the friable pollinia in immediate contact with a secreting organ which emits viscid fluid on irritation. Examples: Bird's-nest and Tway-blade (*Listera*).

* ANTHERS TWO.

6. CYPRIPEDIEÆ.—Represented by a single extremely rare indigenous species in Britain, Lady's Slipper (*Cypripedium*), so called from its hollow, slipper-shaped lip.

OVARY inferior, 1-celled, with indefinite ovules upon 3 parietal placentas. STIGMA usually a concave viscid disk under the column.

FRUIT a capsule, dehiscing usually by valves connected above and below.

USES, &c.—Excepting for the purposes of ornamental cultivation, for which the singularity and beauty of the flowers of a large number of tropical Orchidaceæ, eminently fit them, the Natural Order is of small direct importance to mankind. Vanilla, used to flavour chocolate and confections, is the dried capsules of Tropical American species of the climbing genus *Vanilla*. The tubers of a few terrestrial species of *Orchis*, abounding in gummy and farinaceous matter, are candied as a confection, and in the Isle of Bourbon the leaves of an epiphytal Orchid (*Angræcum*) are dried for use as a stimulant tea.

The Order is of peculiar physiological interest from the circumstance to which Mr. Darwin has recently called attention, in that, with very rare exceptions, self-fertilisation of the flower is mechanically impossible, the species being consequently dependent upon extraneous (insect) aid to secure the transfer of the pollen to the viscid stigma. The special adaptations of the structure of the flower, especially of the form and position of the lip, column, pollen and stigma, designed to secure insect aid and also to insure the transfer of the pollen from flower to flower, are exceedingly curious and well illustrated in common British species.

Of ornamental species in common cultivation in our stoves and plant-houses we have, imported from Tropical America, numerous species of Epidendrum, Cattleya, Lælia, Brassia, Maxillaria, Oncidium, Odontoglossum, Catasetum, Trichopilia, and many others: from Tropical Asia and the Indian Islands, Dendrobium, Aerides, Saccolabium, Eria, Phalænopsis, Vanda and others. The Island of Madagascar affords us the magnificent *Angræcum sesquipedale*, the wax-like cream-coloured flowers of which measure 4-6 inches in diameter; the labellum bearing a spur of 10-15 inches in length.

Natural Order

IRIDACEÆ. Tab. 94.

DIAGNOSIS.—Herbs with radical leaves sheathing at the base. Flowers perfect; perianth-tube adherent, limb 6-leaved. Stamens 3 with extrorse anthers. Ovary inferior, 3-celled. Seeds albuminous.

DISTRIBUTION.—A considerable Natural Order, widely dispersed in both Temperate zones; thinly in the Northern, but very numerous at the Cape of Good Hope. Rare between the Tropics.

NUMBER OF BRITISH GENERA, 5; Species, 7.

ROOT-FIBRES usually from a bulb, as in Crocus and Gladiolus, or from a thickened rhizome as in Iris.

LEAVES radical; in Iris sword-shaped (*ensiform*) and vertically flattened.

PERIANTH usually showy: regular in Crocus with erect segments, in Iris with the 3 outer segments recurved; or irregular as in Gladiolus and Antholyza.

STIGMAS usually 3, filiform, or dilated and fringed in Crocus; broadly membranous, petaloid with a transverse stigmatic notch in Iris.

FRUIT a 3-celled capsule dehiscing loculicidally.

USES, &c.—The dried rhizome of Florentine Iris (*Iris florentina*) is used medicinally as a stimulant. Saffron is the dried stigmas of *Crocus sativus*. It was formerly much esteemed as a stimulant drug, and was extensively cultivated in Essex at Saffron Walden: it has long fallen into disuse excepting as a colouring agent.

The flowers of Iridaceæ are generally very handsome though fugitive, and many species are in cultivation both in the open air and in plant-houses, as yellow, purple and white varieties of *Crocus*, several species of *Iris*, numerous hybrids and horticultural varieties of the gay genus *Gladiolus*, chiefly of Cape species, and the Cape genera *Watsonia*, *Ixia*, *Antholyza*, and others.

Natural Order

AMARYLLIDACEÆ Tab. 95.

DIAGNOSIS.—Perennial usually bulbous herbs with radical or rarely cauline

leaves. Flowers perfect: perianth-tube adherent, limb 6-leaved. Stamens 6; anthers not extrorse. Ovary inferior, 3-celled. Seeds albuminous.

DISTRIBUTION.—A considerable Natural Order, widely dispersed through both Hemispheres in Temperate and Intertropical countries. Most numerous in the South Temperate zone at the Cape of Good Hope and in South America.

NUMBER OF BRITISH GENERA, 3; Species, 4.

LEAVES reversed by a twist at the base so as to bring the underside uppermost in Alstrœmeria, a South American genus cultivated in gardens.

PERIANTH with a cup-shaped appendix (corona), resembling an inner perianth, at the base of the spreading limb, as in Poet's Narcissus (*Narcissus poeticus*), or corona tubular as in Daffodil (*N. pseudo-Narcissus*); or destitute of a corona as Snowdrop (*Galanthus*).

USES, &c.—The so-called American Aloe (*Agave americana*), indigenous in Mexico, and now extensively naturalised in countries bordering the Mediterranean, affords in Mexico a copious saccharine juice from which a much-esteemed beverage called *pulque* is prepared. The genus Aloë belongs to the Natural Order Liliaceæ. The juices of the bulbous Amaryllidaceæ are generally more or less acrid, and in some species dangerous, as in Daffodil.

The flowers of nearly all the species are beautiful, and many genera are garden favourites; amongst the rest Snowdrop (*Galanthus nivalis*), Snowflake (*Leucojum*), and the various species and forms, natural and hybrid, of *Narcissus*, *Amaryllis* including the Belladonna Lily, *Crinum*, *Pancratium*, *Nerine* to which belongs the Guernsey Lily (a native originally of the Cape introduced into Guernsey by shipwreck of a cargo including some bulbs), *Eucharis* of Tropical America, *Alstrœmeria*, *Agave* and *Fourcroya*.

Natural Order

LILIACEÆ. Tab. 96.

DIAGNOSIS.—Herbs, rarely shrubby or arborescent in exotic genera, with radical or cauline leaves and bulbous, or with fibrous or fascicled, roots. Flowers rarely unisexual; perianth coloured, free, of 6 distinct or united segments. Stamens 6 (-8), hypogynous or epiphyllous. Ovary superior, 3 (-4)-celled. Seeds albuminous.

DISTRIBUTION.—A vast Natural Order, generally diffused throughout the Temperate and Tropical zones of both Hemispheres; especially numerous in Southern Africa and the warmer countries of the North Temperate zone in the Old World. The Canary Islands possess a remarkable arborescent species, the Dragon Tree (*Dracæna Draco*), individuals of which occasionally attain an immense age.

NUMBER OF BRITISH GENERA, 20; Species, 30.

Liliaceæ, as usually circumscribed, include several groups very dissimilar in general habit, but nearly all agreeing in the characters of the above diagnosis. The more important of these groups, distinguished as Sub-orders, are:—

1. TRILLIDEÆ.—Leaves net-veined, whorled. Flowers perfect. Stigmas distinct. Fruit a berry. Example: Herb Paris (*Paris quadrifolia*).

2. LILIEÆ.—Leaves parallel-veined. Flowers perfect. Styles united. Fruit a capsule. Examples: Lily (*Lilium*), Tulip (*Tulipa*), Hyacinth (*Hyacinthus*), Garlick (*Allium*).

3. ASPARAGINEÆ.—Leaves parallel-veined or scale-like. Flowers perfect or unisexual. Styles united. Fruit a berry. Examples: Lily-of-the-Valley (*Convallaria*), Solomon's Seal (*Polygonatum*), Butcher's Broom (*Ruscus*), Asparagus.

4. MELANTHEÆ.—Leaves parallel-veined. Flowers perfect or unisexual. Stigmas distinct. Anthers extrorse. Example: Autumnal Crocus (*Colchicum*).

ROOT tuberous or fibrous from a short stock, as in Asphodel (*Asphodelus*); fibres from a bulb as in Tulip, Hyacinth, and Onion (*Allium*), in each of which the scales of the bulb are broadly overlapping and the bulb smooth, and Lily (*Lilium*), in which the bulb is scaly; or roots from a creeping rhizome as in Lily-of-the-Valley.

LEAVES usually parallel-veined, excepting in Trillideæ; radical or cauline, rarely sub-opposite or whorled; reduced to minute scales subtending branchlets (cladodes), which are fascicled, acicular, and frequently flower-bearing in Asparagus; solitary, stiff, vertical and leaf-like in Butcher's Broom.

INFLORESCENCE various: flowers solitary in Tulip, a raceme in Hyacinth and Lily-of-the-Valley, an umbel in Garlick.

USES, &c.—A few species afford a tenacious fibre used for cordage and the like, as New Zealand Flax (*Phormium tenax*) and Bowstring Hemp, obtained from the leaves of the Indian *Sanseviera zeylanica*. Of drugs, the more important are:—aloes, the inspissated juice which flows from fresh-cut leaves of African species of *Aloë*, one species of which, cultivated in the West Indies, affords Barbadoes aloes; squill, the bulb of *Scilla maritima*, a plant allied to the Hyacinth, collected on the Mediterranean shores of North Africa; colchicum, afforded by the Autumnal Crocus (*Colchicum autumnale*), widely diffused in the meadow-lands of Europe; and veratrum, the root of *Veratrum album*, growing wild in Alpine pastures of Central Europe.

The flowers of many Liliaceæ are eminently beautiful, and species of several genera are amongst our oldest garden favourites, as: White Lily (*Lilium candidum*), now established as though wild in South Europe, though perhaps originally from the East; Orange Lily (*L. croceum*), Martagon Lily (*L. Martagon*), both European species; Tiger Lily (*L. tigrinum*), introduced from Eastern Asia, and many other true Lilies; Lily-of-the-Valley (*Convallaria majalis*), indigenous in Britain and eastward through Europe to Asia; Fritillary and Crown Imperial (*Fritillaria*),

of which one species, the Snake's Head (*F. Meleagris*), is indigenous in the South of England: Tuberose (*Polianthes tuberosa*) of Mexico, cultivated in the South of France for the sake of its delicious perfume; various garden varieties of Tulip, derived from European and West Asiatic species of the genus *Tulipa*, especially from *T. suaveolens*, the parent form of the "Duc van Thol" Tulips, *T. Gesneriana* and *T. turcica*; one species of Tulip (*T. sylvestris*), with pale yellow flowers, is indigenous in Britain; Hyacinths, varying with single and double flowers, white, pale yellow, rose, and purple, to nearly black, derived from *Hyacinthus orientalis* of the Levant; the Cape *Agapanthus* with blue umbellate flowers, and *Kniphofia* with dense sceptre-like scarlet racemes; Adam's Needle and other North American species of *Yucca;* Star of Bethlehem and other species of *Ornithogalum*, and many others.

Natural Order

SMILACEÆ. Tab. 97.

DIAGNOSIS.—A small exotic Natural Order of shrubby or herbaceous usually climbing plants of Tropical and warmer Temperate regions, very nearly allied to Liliaceæ, differing in their net-veined leaves and diœcious flowers.

USES, &c.—This Order derives its economic importance from the medicinal properties of the rhizome of several species of *Smilax* (*S. officinalis* of Tropical America and others), imported as Sarsaparilla.

Black Bryony (*Tamus communis*) is the solitary British representative of another small Order (DIOSCOREACEÆ) differing from Smilaceæ in the inferior ovary and usually dry fruit. The fruit of Black Bryony, however, differs from that of the typical and principal genus of the Order, *Dioscorea*, in being baccate. Yams, which are amongst the most important esculents of the Tropics, are the farinaceous tubers, often of large size, of various species of *Dioscorea*.

Natural Order

JUNCACEÆ. Tab. 98.

DIAGNOSIS.—Herbs with radical or cauline leaves. Flowers small, usually perfect. Perianth scarious, free, of 6 distinct persistent segments. Stamens 6, hypogynous or epiphyllous. Ovary superior, 3-celled, or 1-celled with 3 parietal placentas. Seeds albuminous, with a minute embryo.

DISTRIBUTION.—A small Natural Order, most numerous in Temperate, Arctic, and Alpine localities, usually affecting moist situations.

NUMBER OF BRITISH GENERA, 2; Species, 25.

LEAVES flat, grass-like, often thinly pilose in Woodrush (*Luzula*); reduced to sheathing scales at the base of the fertile or barren scapes as in Common Soft Rush (*Juncus communis*); cylindrical, hollow, with cross-partitions in Jointed Rush (*J. articulatus*).

INFLORESCENCE cymose, often fascicled or densely panicled; in Soft Rush with the outer bract continued beyond the panicle as an apparently direct prolongation of the scape.

CAPSULE 1-celled, with 1 seed to each placenta in Woodrush; usually 3-celled, many-seeded in Rush (*Juncus*).

USES, &c.—Of the spongy, cellular pith of Soft Rush the wicks of rushlights used to be made. This tissue, under the microscope, well exhibits a stellate form of cell with wide intercellular spaces.

BROMELIACEÆ.—An exotic Natural Order, confined to the New World, chiefly tropical or subtropical. Allied to the petaloid Orders of Monocotyledons with an inferior ovary, characterised by a perianth, usually adherent,

of 6 segments, of which the 3 outer are sepaloid, the 3 inner petaloid, stamens 6, and ovary 3-celled, wholly or partially inferior.

Most of the species are stemless herbs, frequently epiphytal, with stiff, sheathing, scurfy, often spinosely serrate leaves and spicate racemose or panicled, often handsomely coloured, inflorescence.

USES, &c.—The most important species of the Order is Pine-apple (*Ananassa sativa*), much cultivated in stoves for its delicious collective fruit which results from a dense spike of flowers, the whole of which, flowers, bracts and axis of the spike, becomes succulent. The seeds are not developed in the cultivated fruit, and the species is propagated by separation of the crown of empty bract-leaves borne by the axis of the infructescence immediately above the fruit. The Pine-apple and an allied species afford a fine and tenacious fibre used for textile purposes.

SCITAMINEÆ.—A large Tropical Natural Order, common to both Hemispheres, related to the above, differing from the Orders enumerated in their irregular flowers with but a single anther-bearing stamen, the anther 2-celled in the Sub-order ZINGIBEREÆ (Gingers), 1-celled in the Sub-order MARANTEÆ (Arrowroots); or with the stamens varying from 1 to 6 in number in the Sub-order MUSEÆ.

USES, &c.—The Sub-order ZINGIBEREÆ is characterised by aromatic stimulant properties, especially marked in ginger, the dried rhizome of *Zingiber officinale*, cultivated extensively in the Tropics of both Hemispheres. To this Sub-order belong turmeric (*Curcuma longa*) of Tropical Asia, the powdered rhizome of which is used as a condiment, as a dye, and also as a test for the presence of alkalies; zedoary, the aromatic tubers of *Curcuma Zedoaria* employed medicinally; cardamoms, the fruit of Indian species of *Elettaria;* and Grains of Paradise, the pungent seeds of *Amomum Melegueta* of West Tropical Africa.

The Sub-order MARANTEÆ is destitute of the pungency of Zingibereæ. It includes arrowroot (*Maranta arundinacea*) of the West Indies, the rhizomes of which abound in a fine farina, and Tous-les-mois (*Canna edulis*), another species affording a farina, chiefly used by invalids. The leaf-fibres and petioles of various Maranteæ are much used for matting, basket-work, and the like in their native countries.

To MUSEÆ belong the Banana (*Musa Sapientum*) and Plantain (*M. paradisiaca*), two closely-related plants, yielding fruits of the first importance to the natives of tropical countries. They are very extensively planted throughout the humid hotter parts of both Hemispheres, though probably not indigenous in the New World. Manila hemp is a tenacious fibre afforded by *Musa textilis* of the Philippine Islands.

MONOCOTYLEDONS WITH GLUMACEOUS FLOWERS.

Natural Order

CYPERACEÆ. Tab. 99, 100.

DIAGNOSIS.—Herbs with narrow grass-like sheathing radical leaves with closed sheaths. Flowers spicate or capitate; perfect with hypogynous stamens, or unisexual; naked or perianth reduced to bristles; each flower in the axil of a single scaly bract. Embryo at the base of copious albumen.

DISTRIBUTION.—A very large Natural Order, generally dispersed over the Globe from the Equator to the limits of vegetation, both in latitude and altitude. Most of the species affect moist situations. Of the two largest genera, one (*Carex*), represented by about 50 species in Britain, decreases from the Arctic zone southward, while the second (*Cyperus*), represented in Britain by two rare and local species, is most abundant in Tropical and Subtropical countries.

NUMBER OF BRITISH GENERA, 9; Species, 92.

FLOWERS hermaphrodite as in *Cyperus* and *Scirpus*, or unisexual as in *Carex*; without lateral bracteoles as in Cyperus, Cotton-sedge (*Eriophorum*), and Scirpus, or with a pair of lateral bracteoles as in the rare British genus *Kobresia*, or with the lateral bracteoles (or a single bracteole ?) wholly confluent in a flask-shaped investment (perigynium) of the pistillate flower as in *Carex*.

PERIANTH wanting as in *Carex* and *Cyperus*; consisting usually of 3 or 6 bristles in *Scirpus*, or very numerous and hair-like bristles growing out after flowering in Cotton-sedge.

STAMENS usually 3.

OVARY free, 1-celled, with a solitary erect anatropous ovule; styles 3 or 2.

FRUIT a flattened or triangular achene.

SEED albuminous; albumen copious, mealy.

USES, &c.—These are comparatively unimportant. The small tubers of a North African *Cyperus* (*C. esculentus*) containing oil and farina are edible, and have been collected as food from time immemorial. The cellular pith of the tall stems (culms) of *Papyrus antiquorum*, formerly abundant on the banks of the Nile, furnished the papyrus used as paper by the ancient Egyptians. The stems of Common Scirpus (*S. lacustris*) are gathered in the fens for basket-making, matting, bottle-covers, chair-bottoms, and the like. Sand Carex (*C. arenaria*) is a maritime species, useful in binding shifting sands.

Natural Order

GRAMINEÆ. Tab. 101, 102.

DIAGNOSIS. — Herbs, rarely shrubby or arborescent (as in Bamboo). Leaves radical or alternate, with split sheaths. Flowers usually perfect, sheathed by scaly 2-rowed bracts, of which the innermost is usually 2-nerved. Embryo at the base of, but obliquely outside, a copious albumen.

DISTRIBUTION.—An enormous Natural Order, abounding from the Equator to the limits of vegetation; in temperate regions forming the principal proportion of the herbaceous covering of the soil.

NUMBER OF BRITISH GENERA, 44; Species, 110-114.

INFLORESCENCE usually panicled, the spikelets pedicellate, panicles lax and spreading or denser and spiciform; in Tribe Hordeineæ and a few others closely spicate and spikelets sessile.

SPIKELETS consisting of distichous, imbricate, chaffy scales (glumes), and one, few or many flowers (florets); flowers perfect, or the upper (*Poaceæ*) or lower (*Panicaceæ*) imperfect or rudimentary: very rarely dicœcious.

HYPOGYNOUS SCALES (*lodicules*) minute, 2, 3, or none.

STAMENS hypogynous, usually 3, 2 in Vernal Grass (*Anthoxanthum*), 6 in Rice (*Oryza*).

OVARY free, 1-celled, with 1 ovule; stigmas feathery, 2 or rarely 1 as in Mat Grass (*Nardus*) and Indian Corn (*Zea*).

FRUIT a dry, 1-seeded grain (*caryopsis*), the pericarp adherent to the seed; either free as in Wheat, or at length adherent to the inner glumes as in Barley and Oat.

SEED albuminous; albumen farinaceous.

The genera of this vast Natural Order may be grouped under two Sub-orders, viz. :—

I. PANICACEÆ.—Spikelets 2- or 3-flowered, the central and terminal flower of the spikelet perfect, lower flower or flowers imperfect, either unisexual or neuter, or reduced to a scaly often minute rudiment.

II. POACEÆ.—Spikelets 1- to many-flowered, the central or uppermost and terminal flower of the spikelet rudimentary.

Of PANICACEÆ the principal Tribes in Britain or in cultivation are :

1. PANICEÆ.—Spikelets 1-2-flowered. Flowering glume usually coriaceous, of firmer texture than the outer glumes. Chiefly tropical and subtropical. Examples : Millet (*Setaria italica*), Panic Grasses (*Panicum*).

2. PHALARIDEÆ.—Spikelets 3-flowered, the 2 lateral flowers imperfect or represented by minute empty glumes within the outer glumes. Examples : Canary Grass (*Phalaris canariensis*), Ribbon Grass (*Digraphis arundinacea*), Sweet-scented Vernal Grass (*Anthoxanthum odoratum*), Indian Corn (*Zea*).

Of POACEÆ the principal Tribes are :

3. ORYZEÆ.—Glumes rudimentary or wanting. Stamens usually more than 3. Chiefly tropical. Example : Rice (*Oryza sativa*).

4. AGROSTIDEÆ.—Spikelets 1-flowered, usually panicled, if spicate never sessile on the axis of inflorescence. Examples : Bent Grass (*Agrostis*), Timothy Grass (*Phleum*), Fox-tail (*Alopecurus*).

5. STIPACEÆ.—Spikelets 1-flowered. Flowering glume with an awn often of great length articulated at the base, or 3-awned ; closely convolute around the fruit. Example : Feather Grass (*Stipa pennata*).

6. AVENEÆ.—Spikelets 2- or few-flowered, spikelets pedicellate. Outer glumes usually equalling or exceeding the spikelet. Awns when present usually twisted or kneed (*geniculate*). Examples : Oat (*Avena*), Soft Grass (*Holcus.*)

7. FESTUCEÆ.—Spikelets several-flowered, pedicellate. Outer glumes usually shorter than the spikelet. Awns when present straight. Examples: Meadow Grass (*Poa*), Fescue (*Festuca*), Quaking Grass (*Briza*), Cocksfoot (*Dactylis*), Brome Grass (*Bromus*).

8. HORDEINEÆ.—Spikelets 1- or few-flowered, sessile in the notches of the axis of a spicate inflorescence. Examples: Wheat (*Triticum*), Rye (*Secale*), Barley (*Hordeum*), Rye Grass (*Lolium*), Mat Grass (*Nardus*).

9. BAMBUSEÆ.—Spikelets 1- or several-flowered, often sessile or fascicled. Shrubby or tree-like grasses with woody stem. Chiefly tropical. Example: Bamboo (*Bambusa*).

USES, &c.—The Natural Order Gramineæ is unquestionably the most important to mankind in the vegetable kingdom, furnishing everywhere from the most remote antiquity, in their farinaceous albumen, the chief supply of food.

The principal grain-bearing (*cereal*) species are:

RICE (*Oryza sativa*).—Supplying the principal food of the native tribes of Tropical Asia and China. It is probably of Indian origin, though now cultivated extensively in nearly all hot countries, ranging northward into South Europe and the Southern States of North America; some of the finest varieties being produced in the Carolina States. The cultivation of Rice in India and China dates from a very remote period. It is said to have been introduced into Southern Europe by the Arabs. Nearly seven million cwt. of Rice (not in the husk) were imported into the United Kingdom in 1872.

INDIAN CORN or MAIZE (*Zea Maïs*).—Although unknown in the wild state, there can be little doubt of the American origin of this species. There does not exist any historical evidence of its having been cultivated in the Old World prior to the discovery of the New. At the present period its cultivation, although most extensive in America, is general in countries of both hemispheres characterised by warm summer temperature. In the Old World the principal cultivation of Maize is in the Indian Archipelago, Northern Africa, and Southern Europe. Oranges are imported packed in the broadly-sheathing bract leaves of Maize.

RYE (*Secale cereale*).—Probably originally native of Eastern Europe or of Western Temperate Asia, though the form in cultivation has not been satisfactorily identified with any wild species. The culture of Rye is mainly confined to Europe, extending northward into the Arctic zone. In England, Norfolk and Suffolk are the chief Rye-producing counties. It is also frequently grown as a green crop cut in spring for fodder.

OATS (*Avena sativa*).—Cultivated from a remote period in Northern and Central Europe, though not by the Hebrews, Egyptians, Greeks, or Romans. The cultivated plant is nearly allied to a grass (*Avena fatua*) very frequent in Southern and Eastern Europe, and may perhaps be a cultivated form of the same species. Oats is the principal cereal crop in Ireland and Northern Scotland, as also in Norway, where its cultivation extends northward into Finmark, though falling short of the limit of Rye.

WHEAT (*Triticum vulgare*).—Cultivated very largely throughout the North Temperate zone. In the Old World it has formed the principal staple of food in temperate regions from the most remote period of which we have record. It is frequently referred to in the Holy Scriptures, and there is historical record of its having been cultivated in China 2800 years before the Christian era. It is not known in the wild state. Some botanists have supposed that it may have originated from a grass (*Ægilops ovata*) wild in the South of Europe, allied to Wheat, between which and the cultivated plant intermediate forms have been observed. There cannot, however, be any doubt of the hybrid origin of these intermediates. From fine varieties of Wheat grown in Italy and Sicily, Maccaroni and Vermicelli are prepared. The straw is used for thatch, litter, plaited work, and in paper-making.

BARLEY (*Hordeum vulgare*).—Cultivated by the ancient Hebrews and Egyptians, and at the present period very extensively in one or other of its varieties throughout the temperate regions of the Old World; its cultivation extending farther north and to higher elevations than that of any other cereal. It is a regular crop at Alten in Finmark, latitude 70° North. The 1-flowered spikelets are arranged in threes in alternate joints of the axis of the spike. In Two-rowed Barley the central spikelet only of each set of 3 contains a fertile flower, while in Six-rowed Barley (*Hordeum hexastichon*), grown in Eastern countries, each of the spikelets contains a fertile flower. "Malt is prepared by steeping Barley for about 50 hours, and then exposing it on a floor of slate or cement until it germinates. It is then heated in a kiln to 160° or 180°, then 'screened' so as to separate the sprouted radicles. Germination converts the starch of the albumen into a kind of sugar capable of vinous fermentation, by which process alcohol is formed. In brewing the malt is steeped so as to dissolve out the soluble sugar, forming the sweet wort. This is left to ferment, hops being added to impart a bitterness and preserving quality." Scotch or Pot Barley is the grain deprived of the adherent glumes by grinding.

SUGAR CANE (*Saccharum officinarum*).—Probably native originally in Tropical Asia, though never met with in the wild state. It is cultivated chiefly in India, Mauritius, the East and West Indian Islands, and Brazil. The

solid jointed stems (canes) grow to a height of 6-15 feet. These are gathered before expansion of the flowers, and from the saccharine juice, expressed by rollers, then evaporated and purified, the different varieties of sugar are prepared by various processes affecting the crystallisation and colour. The uncrystallisable remainder is drained off as molasses. Upwards of twelve and a-half million cwt. of unrefined sugar were imported into the United Kingdom in 1872.

Sorghum vulgare and allied species and *Penicillaria*, the former a panicled grass, the latter bearing its grains in long dense cylindrical spikes, are the principal corn-plants of Tropical Africa, while in Tropical Asia, besides Rice, species of Millet (*Panicum miliaceum* and allies) and *Eleusine* are the common cereals.

CANARY SEED, used to feed cage-birds, extensively grown in Kent and Essex, is the produce of *Phalaris canariensis*, a Mediterranean species not indigenous in Britain.

BAMBOOS (*Bambusa arundinacea* and allied species) are applied in warm countries, more especially in Tropical Asia and China, to an infinite variety of purposes. From the juice a fermented beverage is prepared. The young shoots serve as Asparagus. The hollow, transversely-partitioned stems are used in constructing houses, bridges and the like, or are cut up into articles as diverse as ear-rings and water-buckets.

A fragrant essential oil is afforded by Indian species of *Andropogon*, as the Lemon Grass (*A. citratum*), frequently cultivated in our hot-houses.

The more important artificial Grasses cultivated in Britain for hay and pasture are species of Rye Grass (*Lolium perenne* and *L. italicum*), Meadow Grass (*Poa pratensis* and *P. trivialis*), Fescues (*Festuca*), Fox-tail (*Alopecurus pratensis*), Timothy Grass (*Phleum pratense*), and Cocksfoot (*Dactylis glomerata*). Esparto Grass (*Lygeum Spartum* and *Macrochloa tenacissima*) of the Mediterranean shores, remarkable for its wiry tenacious leaves, is largely imported for paper-making, matting, &c. It was used in classical times for coarse cordage.

Several species of Himalayan and Japanese Bamboo; the Pampas Grass (*Gynerium argenteum*), introduced from the plains of the southern portion of South America; Ribbon Grass, a variegated variety of the indigenous *Digraphis arundinacea*; Feather Grass (*Stipa pennata*), remarkable in its long feathery awns, and species of Reed, as the New Zealand *Arundo conspicua* and South European Provence Reed (*Arundo Donax*), are frequently cultivated for ornamental purposes in our gardens.

NATURAL ORD

TABLE OF GENE

MOST IMPORTANT AS INCLUDING FOOD-PRODUCING SPECIES, AND

*THE SIGN * DENOTES A STRIKING DEVIATION*

NAME OF GRASS.	FORM OF INFLORESCENCE.	Number of Flowers in each Spikelet.	Number of Outer Empty Glumes.
Vernal grass (*Anthoxanthum*).	Oblong spicate panicle ; spikelets pedicellate.	One	Four*
Fox-tail (*Alopecurus*).	Cylindrical spicate panicle ; spikelets pedicellate.	One	Two
Rice (*Oryza sativa*).	Drooping lax panicle ; spikelets pedicellate.	One	Two (minute)
Feather Grass (*Stipa pennata*).	Panicle.	One	Two
Indian Corn or Maize (*Zea Maïs*).	Monœcious: staminate flowers in terminal panicles, pistillate flowers in axillary spikes.	Two, one imperfect	Two Two
Rye Grass (*Lolium perenne*).	Distichous spike ; spikelets sessile edgewise on axis.	Several	One*
Mat Grass (*Nardus stricta*).	Unilateral spike ; spikelets sessile.	One	0*
Wheat (*Triticum vulgare*).	Distichous spike ; spikelets sessile broadside on axis.	Several	Two
Rye (*Secale Cereale*).	Distichous spike ; spikelets sessile broadside on axis.	Two	Two
Barley (*Hordeum vulgare*).	Distichous spike ; spikelets sessile on the axis in 3's.	One	Two
Oats (*Avena sativa*).	Spreading or unilateral panicles ; spikelets pedicelled.	Two	Two
Sugar Cane (*Saccharum officinarum*).	Ample spreading panicle.	One	Three

ER GRAMINEÆ.

RA OF GRASSES.

OF BRITISH GENERA PRESENTING EXCEPTIONAL CHARACTERS.

FROM THE NORMAL STRUCTURE OF GRASSES.

Flowering Glume.	Pale.	Number of Lodicules.	Number of Stamens.	Number of Styles.	INDIGENOUS OR CULTIVATED IN BRITAIN.
One	One	0*	2*	2	Common in Britain ; extends through Europe into Northern Asia.
One	0*	0*	3	2	North Temperate zone. Common in Britain.
One	One	2	6*	2	Cultivated in warm countries. Not indigenous in Europe.
One (with very long awn)	One	3*	3	2	South Europe and Levant. In gardens only in England.
One	One	2	3	0*	Of American origin. Cultivated in gardens only in Britain ; as a Cereal in countries of warm summer temperature.
One	One	0*	0*	1* (very long)	
One	One	2	3	2	North Temperate zone. Common in Britain.
One	One	0*	3	1*	Common on heaths and moorland pastures in Britain ; extending through Europe into Northern Asia.
One	One	2	3	2	Extensively cultivated in Britain and in Temperate countries generally.
One	One	2	3	2	Cultivated in Britain, as a Cereal chiefly in the Eastern counties.
One	One	2	3	2	Extensively cultivated in Britain.
One	One	2	3	2	Cultivated in Britain and Northern Europe.
One	One	2	3	2	Only in warm countries. Not indigenous in Europe.

CRYPTOGAMS OR FLOWERLESS PLANTS.

Natural Order

FILICES. Tab. 103.

DIAGNOSIS.—Leafy expansions (*fronds*) curled upon themselves like a crosier (*circinate*) before unfolding (except in Adder's Tongue). Fructification upon the under surface or margin of the frond, consisting of minute usually densely-clustered capsules (*sporanges*) of one kind, containing microscopic doubly-coated cells (*spores*), destitute of an embryo, but capable of developing a small green leafy expansion (*prothallus*) bearing the essential organs of reproduction.

DISTRIBUTION.—A large group, generally dispersed over the Globe from the Equator to the limits of vegetation, but especially abundant in humid climates. Some species, however, are capable of resisting extreme drought, maintaining themselves in chinks of rock and masonry exposed to a burning sun. The Order is one of the oldest of which remains are found in the fossil state. Its relative abundance especially characterised the carboniferous period.

NUMBER OF BRITISH GENERA, 20; Species, 43.

STEM a creeping rhizome in Brake (*Pteris aquilina*) and Polypody (*Polypodium vulgare*); very slender in Oak Fern (*Polypodium Dryopteris*) and the Filmy Ferns (*Hymenophyllum*); a short, thick, prostrate rhizome in Shield Ferns (*Aspidium*) and Lady Fern (*Athyrium*), or erect, occasionally attaining many feet in height, in the Tree Ferns (*Cyathea, Alsophila, Dicksonia*, &c.) of the Tropics and South Temperate zone.

FROND simple, undivided in Hart's Tongue (*Scolopendrium*) and Adder's Tongue (*Ophioglossum*); forking, with few narrow segments, in Forked Spleenwort (*Asplenium septentrionale*); simply pinnate in Polypody, Hard Fern (*Blechnum*), and Ceterach; with fleshy semilunar segments in Moonwort (*Botrychium Lunaria*); twice or thrice pinnate in Shield Ferns, Brittle Fern (*Cystopteris*), and many others; segments (pinnules) wedge-shaped in Maiden-hair (*Adiantum*); barren and fertile (sporange-bearing) fronds, either similar as in Shield Ferns and most other genera, or more or less dissimilar as in Hard Fern, Parsley Fern (*Allosorus*), and Osmunda: midrib (rachis) of the frond usually with scaly hairs (ramentum), at least towards the base of the frond.

SPORANGES solitary, or in clusters of 2 or 3 on the under surface of the frond in the exotic tribe Gleicheniæ; usually collected in dense clusters (*sori*), circular, reniform, linear, or oblong in outline; with a membranous envelope (*indusium*) at length opening as in Shield Ferns and Spleenwort, or naked as in Polypody, or linear protected by the folding over of a narrow margin of the frond as in Brake, or actually inserted upon the inner side of the folded margin as in Maiden-hair: sori entirely covering specially modified portions of the frond as in Osmunda, collected in a narrow simple spike in Adder's Tongue, or in a branched spike in Moonwort (*Botrychium*).

REPRODUCTIVE ORGANS microscopic, of two kinds (*antheridia* and *archegonia*), developed upon the under surface of minute green leafy expansions given off by the spores on germination. Antheridia containing an indefinite number of very minute cellules, each enclosing a spiral filament (*antherozoid*) bearing cilia, and motile in water. Archegonia each containing an embryonal cell at the bottom of a narrow tubular cavity. To these the antherozoids (which are homologous with the pollen-grains of flowering plants) find access, and by their contact with the embryonal cell render the latter capable of direct development into a new Fern-plant.

The principal Tribes of this large Order are :—

* VERNATION CIRCINATE.

1. POLYPODIEÆ.—Sporanges with a vertical elastic ring, collected in sori of various shapes upon the under surface of the fertile frond, rarely entirely covering this surface. To this group belongs the great majority of our European Ferns.

2. HYMENOPHYLLEÆ.—Sporanges with an oblique or transverse ring, borne upon excurrent nerves of the pellucid fronds. Chiefly tropical or subtropical, and all affecting very humid stations. Three British species belong to this group.

3. OSMUNDEÆ.—Sporanges with an incomplete transverse ring, opening across the apex. A small group, represented in Britain by the "Flowering Fern" (*Osmunda regalis*).

* VERNATION NOT CIRCINATE.

4. OPHIOGLOSSEÆ.—Sporanges destitute of a ring, opening in two valves, arranged in a simple or branched spike. A small group, represented by the Adder's Tongue (*Ophioglossum*) and Moonwort (*Botrychium*) in Britain.

USES, &c.—The Order is not of much economic importance. The cellular portion of the stem and rhizome affords in a few species a coarse food to savage tribes, and a few have a medicinal repute, as Male Shield Fern (*Aspidium Filix-mas*), which is celebrated as an anthelmintic.

The graceful form and delicately-divided fronds of nearly all the members of the family eminently fit them for ornamental cultivation, especially upon shady rockwork, in conservatories, and in parlour glazed Wardian cases.

Natural Order

EQUISETACEÆ. Tab. 104.

DIAGNOSIS.—Herbs with hollow jointed stems, simple or with slender whorled jointed branches. Fructification consisting of numerous closely-packed peltate scales, bearing capsules (sporanges) of one kind underneath, collected in a terminal spike. Outer coat of the spores splitting into elastic, attached, hygroscopic filaments (elaters); spores developing a prothallus as in Filices.

DISTRIBUTION.—A very small Natural Order, consisting of the solitary genus Horsetail (*Equisetum*), most numerous in the North Temperate zone, with but few Tropical representatives. A Tropical American species is said to attain a height of 20-30 feet. The remains of plants allied to the Horsetails abound in rocks of great geological age, associated with the impressions of Ferns.

ONE BRITISH GENUS; Species, 9.

STEM erect from a creeping rhizome; barren and fertile similar as in Wood Horsetail (*Equisetum sylvaticum*) or Scouring Rush (*E. hyemale*); or dissimilar, the fertile stem unbranched, precocious and early withering, as in the Common Horsetail (*E. arvense*) and Great Horsetail (*E. Telmateia*). Stem usually simple in Scouring Rush, or with more or less numerous verticillate branches as in Field and Wood Horsetail. Joints of the stem and branches with toothed sheaths.

SPORANGES usually 6-9 to each peltate scale of the fruit-spike, inflected around the margin of the umbrella-like top of the scale parallel with its stalk.

REPRODUCTION as in Filices.

USES, &c.—One species, the Scouring or Dutch Rush (*E. hyemale*), in which a siliceous deposit is abundant in the epidermis, is used to polish wood and metal.

Natural Order

LYCOPODIACEÆ. Tab. 105.

DIAGNOSIS.—Trailing or tufted, often slender or wiry herbs with small 2 (4)-rowed or scattered imbricating leaves, or aquatic or terrestrial stemless herbs with tufted linear or subulate sheathing leaves (*Isoetes*). Fructification consisting of sporanges in the axils of the stem-leaves, or collected in terminal spikes containing spores of one or two kinds, either minute and indefinite (microspores) developing antherozoids, or larger and definite (macrospores) developing a prothallus bearing archegonia.

DISTRIBUTION.—A small Natural Order, represented in every quarter of the Globe. Two common British species, Stag's-horn Moss *(Lycopodium clavatum)* and Fir Club-moss *(L. Selago)*, have a very wide distribution, occurring in both Hemispheres as well as south of the Equator.

NUMBER OF BRITISH GENERA, 2; Species, 8.

LEAVES linear or subulate, all similar and imbricate around the stem in British Club-mosses (*Lycopodia*); submerged, linear, quill-like and tufted in Quillwort (*Isoetes lacustris*); or of two kinds, membranous, very small and various in form, the larger distichously arranged in the plane of ramification, the smaller intermediate, appressed, and resembling stipules, as in Garden *Selaginellas*; minute, distantly scattered, and scale-like in the exotic genus *Psilotum*.

SPORANGES 1-celled; in *Selaginella* of two kinds, containing either macrospores or microspores; in *Lycopodium* but one kind has been discovered, containing microspores; sporanges in *Psilotum* 3-celled; in Quillwort of two kinds as in *Selaginella*, but divided by transverse partial or complete partitions into several cells.

REPRODUCTION not yet completely observed in Club-mosses (*Lycopodia*); in *Selaginella* a narrow, scarcely-protruding, crescent-shaped prothallus is developed upon one side of the macrospores, bearing archegonia analogous to those on the prothallus of Ferns. The antheridia set free by the microspores under favourable conditions as to humidity and temperature resemble those of Ferns and Horsetails, and the archegonia are fertilised by their contact as in these groups.

USES, &c.—The copious microspores of Stag's-horn Moss are readily inflammable, and used to be collected for stage effect of lightning. A few species have an obscure medicinal value in their respective countries. Many species of *Selaginella* are cultivated in our greenhouses and for covering rockwork in Ferneries.

Allied to Lycopodiaceæ, though very different in habit, is the small Order MARSILEACEÆ, represented in Britain by Pillwort *(Pilularia)*, a low, grass-like, creeping aquatic with slender leaves circinately unfolding and bearing globose subsessile sporanges resembling grains of pepper. The sporanges are 4-celled, and each cell contains two kinds of spore, answering to the two kinds respectively in Quillwort and Selaginella. Pillwort is frequent, though easily overlooked, on the shallow margins of fresh-water pools in Britain. An Australian ally, with clover-like leaves (*Marsilea salvatrix*), bears edible sporanges.

Natural Order

MUSCI. Tab. 106.

DIAGNOSIS.—Low herbs with filiform or slender wiry stems and minute alternate usually spirally arranged imbricating leaves, destitute of vascular tissue. Fructification consisting of a stalked sporange usually with a central axis, containing microscopic double-coated spores, of one kind, capable on germination of developing a thread-like branching filament upon which leafy shoots give origin to new plants, which bear the reproductive organs when fully developed.

DISTRIBUTION.—A large Order, represented wherever there is sufficient humidity from the Equator almost to the limits of vegetation, often clothing rocks, the trunks of trees and old masonry. A few species are submerged aquatics.

STEM very slender, composed solely of cellular tissue, the cells of the axis often much elongated, terminating in the fructification, or, if bearing axillary fructification, elongating indefinitely.

LEAVES minute, ovate lanceolate or subulate, usually consisting of a single stratum of cells the form of which affords specific characters to Muscologists: the cells all alike containing green colour-granules (chlorophyll), or of 2 kinds, the colour-cells smaller with larger colourless intermediate cells marked by delicate transverse fibres and often perforate in the genus Bogmoss (*Sphagnum*).

SPORANGES borne upon a slender stalk (*seta*) or subsessile, either terminal (as in Acrocarpous Mosses) or axillary (as in Pleurocarpous Mosses); 1-celled with a central vertical axis (*columella*), the space between the columella and the sides being occupied by the minute spores: sporange covered by a cap (*calyptra*); the mouth

closed by a lid (*operculum*), which usually separates when mature by transverse dehiscence. In the exceptional Tribe Andreæ the sporange is destitute of columella and operculum, and opens by 4 or 8 vertical valves to liberate the spores. Mouth of the sporange naked as in Gymnostomatous Mosses or fringed with a single or double row of separate or trellised teeth (*peristome*).

REPRODUCTIVE ORGANS of two kinds, viz., antheridia and archegonia, sheathed by involucral leaves; either occurring together or upon different parts of the same plant or upon different plants. The ANTHERIDIA are membranous sacs liberating when mature numerous microscopic cellules each containing a spiral motile antherozoid analogous to the antherozoids of Ferns. ARCHEGONIA flask-shaped, containing an embryonal cell at the base which is rendered capable of developing a sporange, with its stalk, by contact of the antherozoids. The sides of the archegonium carried up by the growing sporange ultimately form the calyptra which sheaths the sporange until it is mature.

USES, &c.—Excepting for purposes of packing, bedding, stuffing crevices of timber buildings in Northern countries and the like, Mosses are without any direct economic application. Bog-moss (*Sphagnum*), which forms the great mass of the vegetation of the more saturated portions of bogs, is much employed in horticulture to retain water as a sponge around delicate roots and cuttings.

Very nearly allied to Musci is the small Order HEPATICÆ, some genera of which form, in respect of habit, a transition to the cellular Natural Orders of lower grade in which there is no distinction of stem and leaf. Hepaticæ consist, as to their vegetative portion, either of slender moss-like stems clothed with 2-rowed (*distichous*) leaves, or of a spreading irregularly-lobed green expansion (*thallus*) destitute of leafy organs as in Liverworts (*Marchantia*). In respect of the reproductive organs Hepaticæ differ from Mosses in the sporanges containing, intermixed with the spores, slender cells each enclosing a spiral filament (*elater*). In Liverwort the sporanges result as in Mosses from the fertilisation of an archegonium by an antherozoid, and are borne upon the under side of a radiately-lobed disk which is supported by a slender stalk. This genus is further remarkable in the complex form of the stomates or pores in the epidermis which communicate with the interior of the thallus, as well as in the neat provision for the development of bulbels or buds, which are contained at first in minute cup-shaped involucres, but ultimately scattered and each capable of reproducing the plant.

Natural Order

LICHENES. Tab. 107.

DIAGNOSIS.—Cellular persistent hygrometric plants dependent upon inorganic food, usually grey, yellow, or red, growing upon the ground, upon the bark and leaves of trees, or encrusting rocks or masonry. Fructification consisting of cells (*asci*) containing spores, collected in depressions or cavities of the thallus, which are probably rendered capable of germination (or perhaps of acquiring their full development) by the contact of microscopic corpuscles (*spermatia*) liberated by jointed filaments (*sterigmata*) contained in minute cavities or tubercles upon the same or upon a different thallus.

DISTRIBUTION.—A large group, represented in every quarter of the Globe, but by far most numerous in cool or Arctic climates, forming at extreme latitudes and elevations the very outposts of vegetation. Their growth is intermittent, depending upon sufficient humidity of the atmosphere; their friability in drought being a principal source of their destruction.

VEGETATIVE PORTION (thallus) either CRUSTACEOUS, spreading indefinitely from a centre, with lobed or wavy margin, and closely applied to the surface of stones, bark, &c., or FOLIACEOUS with free, ascending, irregularly-lobed segments, or FRUTICULOUS when ascending and irregularly branched so as to resemble a minute shrub. The thallus in the more typical Lichens, when examined in transverse section, exhibits 3 or 4 more or less distinct horizontal cellular strata, viz., 1st and uppermost, a *cortical* or epidermal coloured or colourless layer; 2nd, immediately underneath a *gonidial* layer, containing minute green cells (*gonidia*) capable of reproducing the plant as buds; 3rd, a *medullary*, entangled, filamentous layer; and 4th, an under stratum from which the radicular fibres are developed. The thallus frequently contains crystals of oxalate of lime and also starch.

REPRODUCTIVE ORGANS:—Sporanges or asci cylindrical or oblong, each usually containing a row of 8 (or fewer or more) spores, and intermixed with slender club-shaped filaments (*paraphyses*), collected together upon receptacles of various form and degrees of concavity, either widely open to the air as in *Gymnospermous* Lichens, or lining the interior of a cavity opening by a minute pore as in *Angiospermous* Lichens. Evidence is not yet satisfactory as to the mode of fertilisation of the spore-containing cells, but it is probably due to the spermatia referred to above.

USES, &c.—A few Lichens which become gelatinous in warm water are edible, as Iceland Moss (*Cetraria islandicus*). Reindeer Moss (*Cladonia rangiferina*) is the main support of the reindeer in the Arctic zone, and is collected in Norway to feed cattle in preference to hay. Other species afford red, yellow, and violet dyes, as species of *Roccella* and *Lecanora*, the orchil, cudbear, and litmus of commerce.

Natural Order

FUNGI. Tab. 108.

DIAGNOSIS.—Cellular, frequently evanescent, plants dependent upon organic matter for their nourishment, variously coloured but never green; the vegetative portion usually embedded and not encrusting. Fructification very various, consisting usually of minute spores, either borne naked upon the surface of the reproductive cells (in SPORIFEROUS Fungi) or enclosed in sporanges or asci (in SPORIDIFEROUS Fungi).

DISTRIBUTION.—A very large group, distributed generally over the Globe, though especially (if not exclusively) where organic matter is undergoing decomposition; occurring often in the most unlikely

habitats, as inside the shell of an egg, upon ink and opium, or upon or within living plants and animals. The species do not appear to be much restricted in geographical range, although a large proportion are confined to a particular habitat.

Several Sub-orders have been proposed as primary divisions of the Order, but no plan has yet met with general acceptance.

VEGETATIVE PORTION (*mycelium*) developing from the spores on their germination or from bud-cells, usually consisting of delicate elongated, filamentous cells, inconspicuous or concealed under the surface of the ground or matrix in which it is growing; or a granular somewhat fluid pulp exhibiting spontaneous motion, in either case capable, under favourable conditions, of developing reproductive cells.

REPRODUCTIVE ORGANS very various, and as yet imperfectly understood, so far as the co-operation of organs analogous to the antheridia and archegonia of the higher Cryptogamous plants is concerned. In Mushroom (*Agaricus campestris*) that portion of the plant which is visible above ground is the spore-bearing organ, the filamentous mycelium being concealed under the surface. The exposed portion consists of an umbrella-like top (*pileus*) supported upon a stout cellular stalk (*stipes*), to which it is attached in the centre. In the early stage of growth the margin of the pileus is united with the stipes by a membrane ultimately ruptured, the remains of which forms a ring (*volva*) around the stipes. The under surface of the pileus consists of numerous radiating, vertical, flattened plates or gills (*lamellæ*), extending from the apex of the stipes to the margin of the pileus. Upon the surface (*hymenium*) of these fleshy plates numerous larger (though microscopic) projecting cells (*basidia*) bear on their apices each 4 very minute, stipitate, naked spores capable of germinating and developing a new mycelium.

In Touchwood (*Polyporus*), a Fungus with a persisting reproductive organ of dense woody texture, and often attaining a large size, attached to decaying trees, the spore-bearing cells are similar to those of Mushroom, but line the interior of the minute vertical tubes, the openings of which are readily distinguishable with a simple lens on the under surface of the exposed portion of the Fungus.

In Puff-balls (*Lycoperdon*) the spore-bearing cells line closed cavities in the firm tissue of the Fungus, which at length becomes dry and pulverulent, the spores being liberated by the rupture and decay of the enclosing leathery coat (*periderm*).

In Truffle (*Tuber*), a species with the entire plant subterranean, the spores are contained in tubular sporanges or asci, usually 4 or 8 in each sporange. These sporanges clothe the surface of the reproductive layer, the convolutions of which give the fleshy tissue of the Truffle a marbled appearance. The spores are liberated by the pulverulent breaking up of the Truffle.

In the common Blue Mould (*Penicillaria*) covering decaying pasty or semifluid substances the spores are borne in minute necklace-like threads, radiating from the extremity of erect filamentous stalks. Each of the excessively minute cells of the moniliform threads is a spore capable of developing a new plant.

USES, &c.—Although the Order generally is suspicious, and many of the species dangerous or actually poisonous, yet a considerable number may, if sound, be cooked and eaten with impunity. Mushroom (*Agaricus campestris*) is the only species cultivated for food in Britain. A few other species of the same genus are esculent, but should be selected with care, especially avoiding all specimens with a disagreeable smell or taste. Other familiar edible species are Truffles (*Tuber melanosporum* and allies) and Morells (*Morchella esculenta*).

Amadou or German tinder is prepared from *Polyporus igniarius* and allies by soaking thin slices in a solution of nitre. Ergot of Rye (*Sphacelia*), used in medicine, is developed upon the ovary of the Rye flower, which it at length obliterates, and projects from the glumes.

Many Fungi under circumstances favourable to their development are very injurious, destroying enormous quantities of agricultural and horticultural produce, timber, and miscellaneous organic substances. Amongst the more noxious are Mildews, Smuts and Bunt of Corn, Blight of Hops, the various Moulds and Dry-rot, and the Fungi infesting the Potato and Vine. Many of these defy extirpation, from the rapidity of their development and multiplication and the excessive minuteness of their spores, which cannot be excluded by any mechanical contrivance.

Natural Order

ALGÆ. Tab. 109.

DIAGNOSIS.—Cellular plants growing in salt or fresh water or upon damp surfaces; usually either some shade of green, olive, or red: very varied in form. Reproduced by division or by the liberation of motile portions of the cell-contents; or from spores resulting from the mingling of the contents of different cells, or by contact of antherozoids.

DISTRIBUTION.—Generally dispersed around the shores and in the inland waters of each quarter of the Globe; the Red and Olive coloured Algæ more numerous in the North and South Temperate zones. Some species occur floating in the open sea, as the Gulf-weed (*Sargassum bacciferum*) found in enormous quantity in an eddy of the Atlantic to the west of the Azores. *Macrocystis pyrifera*, a species of the Southern and Antarctic Oceans, grows to a length of several hundred feet.

This large Natural Order may be conveniently divided into three principal Sub-orders, primarily distinguished by the colour of the thallus :—

I. MELANOSPERMEÆ or FUCOIDEÆ.—Marine species : usually olive-green or brown.

II. RHODOSPERMEÆ or FLORIDEÆ.—Marine species : usually some shade of red, passing into purple or greenish red.

III. CHLOROSPERMEÆ or CONFERVOIDEÆ.—Marine or fresh-water : usually distinctly green, rarely reddish.

I. MELANOSPERMEÆ OR FUCOIDEÆ.

EXAMPLE.—Wrack or Bladder-wrack (*Fucus vesiculosus* and allies), covering rocks between tide marks, very abundant upon the British coast. The long leathery, repeatedly-forking fronds are provided with large embedded, oblong, inflated air-vesicles which serve as floats. In Gulf-weed (*Sargassum*) the air-vesicles are globose and distinctly stalked in the axils of flattened leaf-like branches.

The reproductive organs are contained in the thickened or club-shaped extremities of the divisions of the frond, which may be recognised by their paler colour and the presence of numerous minute pore-like orifices on the surface visible to the naked eye. These orifices communicate with minute cavities lined either with sporanges or with antheridia, or, in some species of Fucus, with both in the same cavity. The sporanges are oblong double-walled cells projecting into the cavity, and attached to its side. Each sporange contains 2, 4, or 8 spores, which when ready for fertilisation are liberated by the rupture of the membrane of the sporange.

The antheridia are very minute cells borne upon branching filaments, attached to the sides of the minute cavities similarly to the sporanges. The contents of each antheridium becomes resolved into a number of excessively minute, rapidly motile, club-shaped antherozoids, each provided with 2 cilia and usually an orange-coloured speck. They are liberated, like the spores, by rupture of the containing cell, and their presence is easily detected in early spring, if examined after exposure of a few hours to the air, by the orange-coloured exudation, from the pores of the cavities containing antheridia, due to crowds of minute antherozoids. The spores are fertilised by contact of the antherozoids, develop a membranous coat, and then commence to germinate.

II. RHODOSPERMEÆ OR FLORIDEÆ.

The species are usually very much smaller than the Melanosperms. Many of the rose-red leaf-like or delicately divided species common upon the sea-shore, especially in rocky tidal pools, are familiar to all frequenters of the coast. The modes of reproduction of the Red Sea-weeds are very varied, and would appear to include multiplication by means of specially developed bud-cells or gemmules as well as reproduction by spores fertilised by antheridia. In the species in which a true sexual reproduction has been observed the spores are fertilised by antherozoids, destitute of cilia and of the power of locomotion liberated from an antheridium, through a long slender filamentous prolongation of its cavity. In the true Corallines (*Corallina*), frequent in tidal pools, the thallus is transversely jointed, and rigid from the deposition of carbonate of lime in its substance.

III. CHLOROSPERMEÆ OR CONFERVOIDEÆ.

The genera included under this Sub-order are exceedingly varied in aspect as well as in their methods of multiplication and reproduction. Some of the simpler forms consist of single microscopic cells which run through a period of vegetative existence, giving rise by repeated division to new individuals, and finally have their contents resolved into a number of minute motile particles (*zoospores*) each capable of reproducing the parent form, or by fusion of their contents with that of another externally similar individual, give rise to spores often capable of remaining quiescent and withstanding drought for a long period before germinating and repeating the same cycle of changes. Such are the Desmidieæ and their allies, familiar to microscopists, and frequent in freshwater pools upon our heaths and moorlands.

A higher degree of complexity is presented by those species which occur in the form of delicate hair-like filaments, consisting of cells joined end to end. Many of these are very abundant in freshwater ponds and ditches, often rising to the surface in cloudy green, or if in a reproductive stage, yellowish, masses. In the filamentous species a prevalent mode of multiplication is by means of ZOOSPORES—portions of cell-contents, or sometimes the entire contents of a cell, set free by rupture of the cell-wall. These are capable of locomotion in water and ultimately of independent development as new individuals. A second mode of multiplication is by CONJUGATION, the union of different cells of the same or of different filaments by transverse connecting tubes through which the contents become mingled, resulting in a spore. In many genera a true sexual reproduction by means of antherozoids, and spores which are fertilised by their contact, takes place, though with manifold variations in the method.

USES, &c.—Many mucilaginous Algæ are esculent and are collected as food by the poor inhabitants of remote northern coast regions. The so-called Irish Moss or Carragreen (*Chondrus crispus*) used by invalids, and the coarser forms in cattle-feeding, is a common British species.

Wrack (*Fucus*) used formerly to be largely collected, and to some extent is still on our northern shores, in order to burn for the sake of its alkaline ash (kelp) and the iodine which it affords. This ash contains from 5 to nearly 9 per cent. of carbonate of soda. Large use is made of Fucus as a manure on coast farms.

CHARACEÆ is a small group usually associated with the Algæ and agreeing with that Family in

their aquatic habit, but presenting some anomalous and complex conditions in their reproductive organs. The species occur wholly submerged and are frequent in fresh or brackish waters all over the Globe. The stem is usually slender, consisting of long simple cells end to end, giving off whorled branches at the joinings (*Nitella*), or the cells of the axis are wound around spirally by several parallel secondary filiform cells (*Chara*).

The reproductive organs are of two kinds: 1. Globose orange-coloured capsules, each consisting of 8 concave triangular plates accurately fitted to each other by their margins, from the centre of each of which there projects into the cavity of the capsule a filament bearing a bundle of antheridia. The antheridia when mature liberate by rupture microscopic spiral, motile antherozoids. 2. Oblong capsules (called nucules), consisting of a central ellipsoidal cell enveloped by 5 spirally-wound cells, the tips of which project at the apex. In this nucule the single spore is developed by contact of the antherozoids.

Species of *Nitella* are well adapted, from the large size of the cells of the stem, for demonstrating the motion of the cell-contents, rendered obvious under the microscope by longitudinal currents which carry coloured granular matter in their course.

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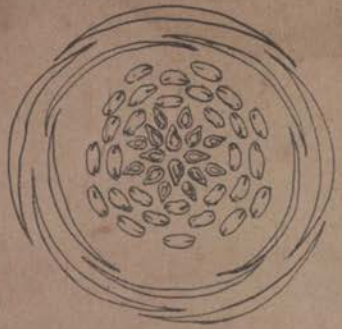


DIAGRAM OF FLOWER.

Ranunculaceæ.

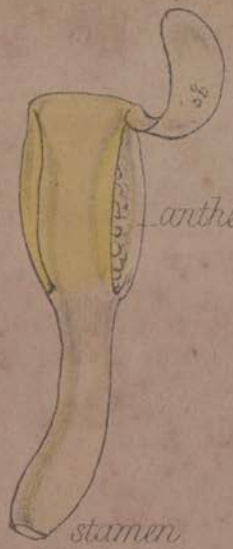
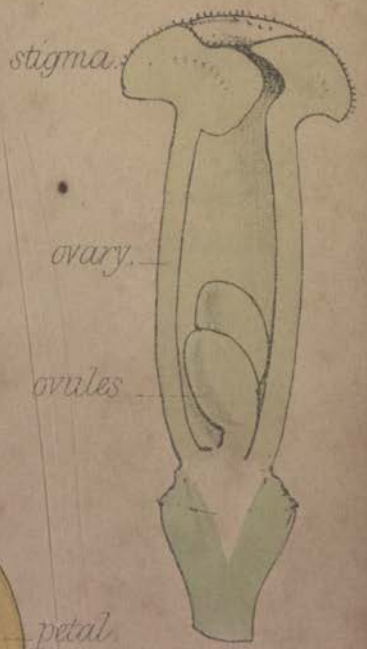


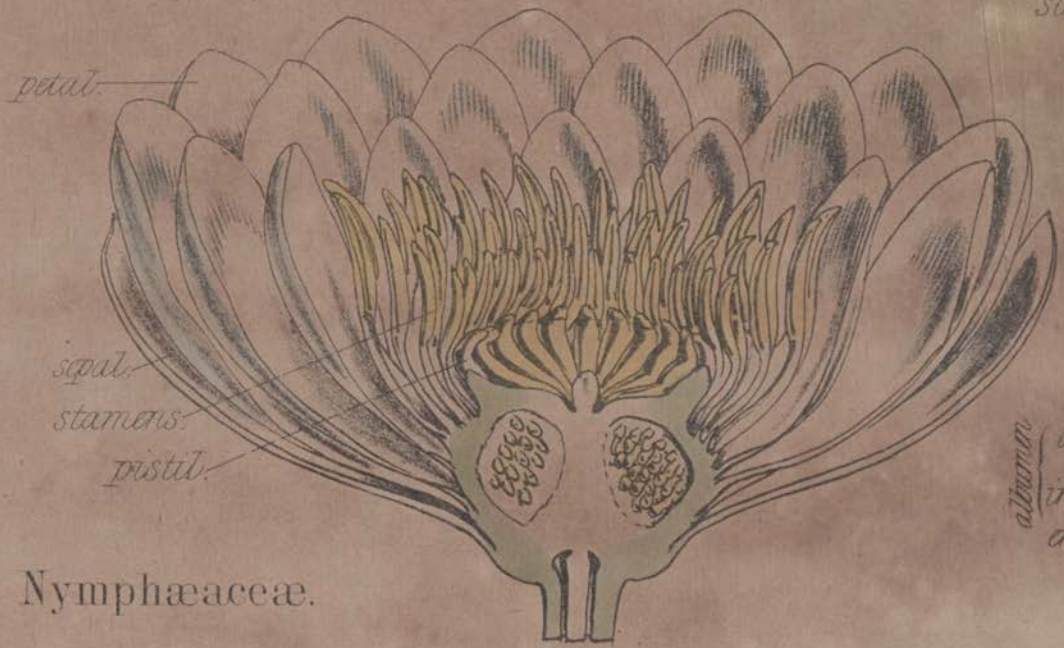
DIAGRAM OF FLOWER.



Berberidaceæ

DIAGRAM OF FLOWER.

3.



Nymphæaceæ.

anterior

posterior outer petals.

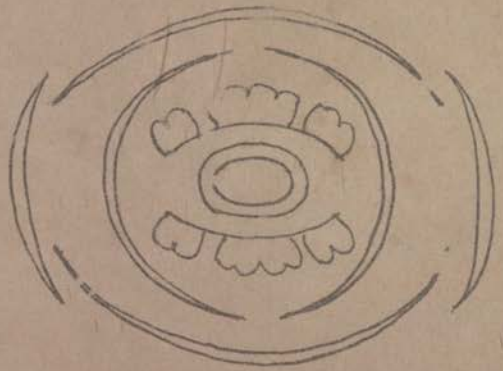


DIAGRAM OF FLOWER.

inner petals.

anthers.

filaments.

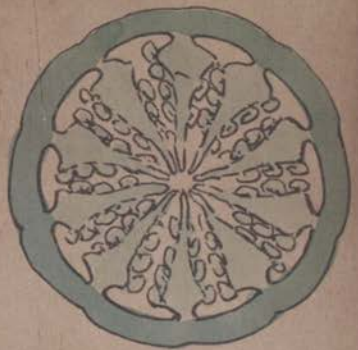
sepal.

ovary

Fumariaceæ.

DIAGRAM OF FLOWER.

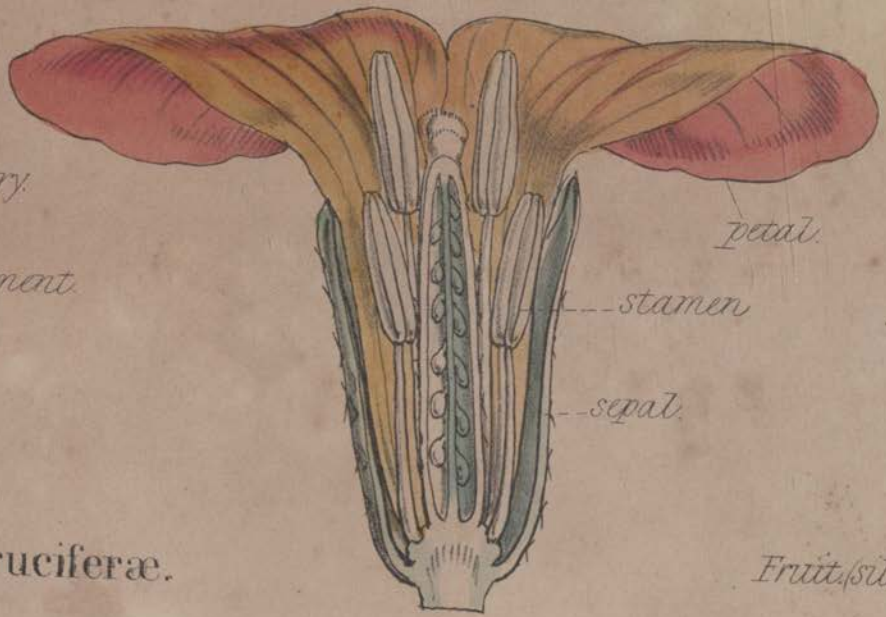
Capsule



Transverse section of fruit

Papaveraceæ.

DIAGRAM OF FLOWER.

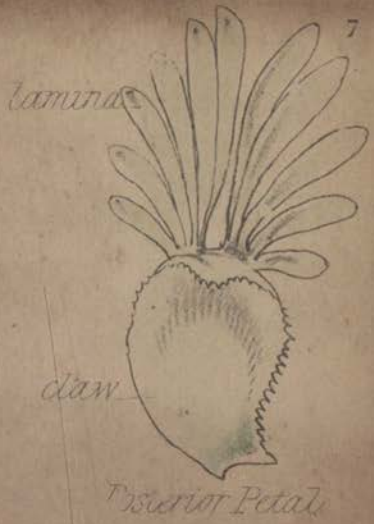


Cruciferæ.

Fruit (siliqua)

lamina
claw
Anterior Petal

DIAGRAM OF FLOWER


lamina
claw
Posterior Petal

petal
pistil
stamen
sepal

embryo

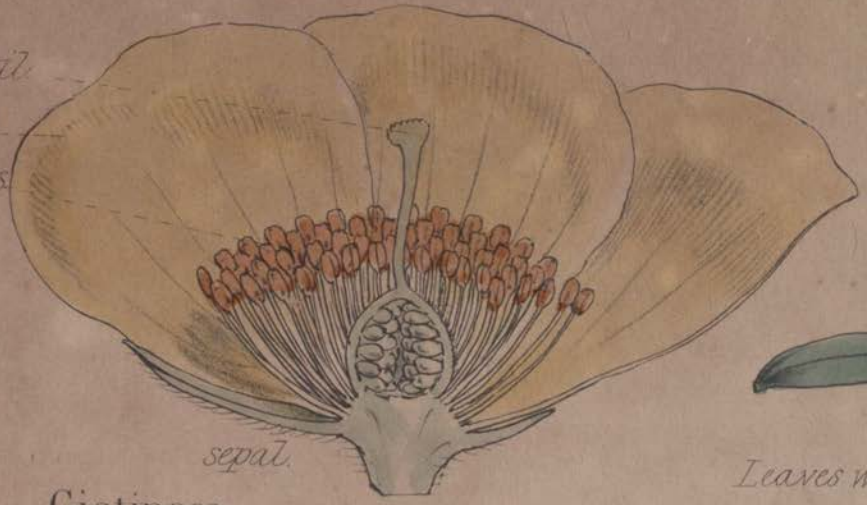
fruit

Resedaceæ.

calyx.

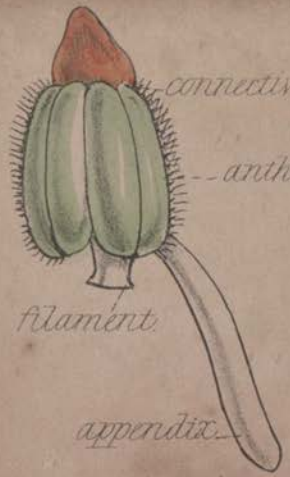
DIAGRAM OF FLOWER.

seed.



Leaves with stipules.

Cistineæ.



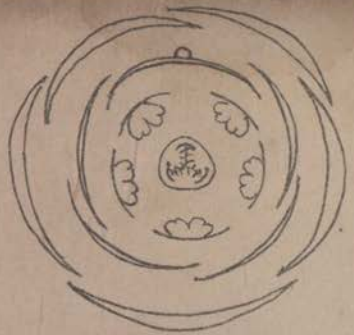
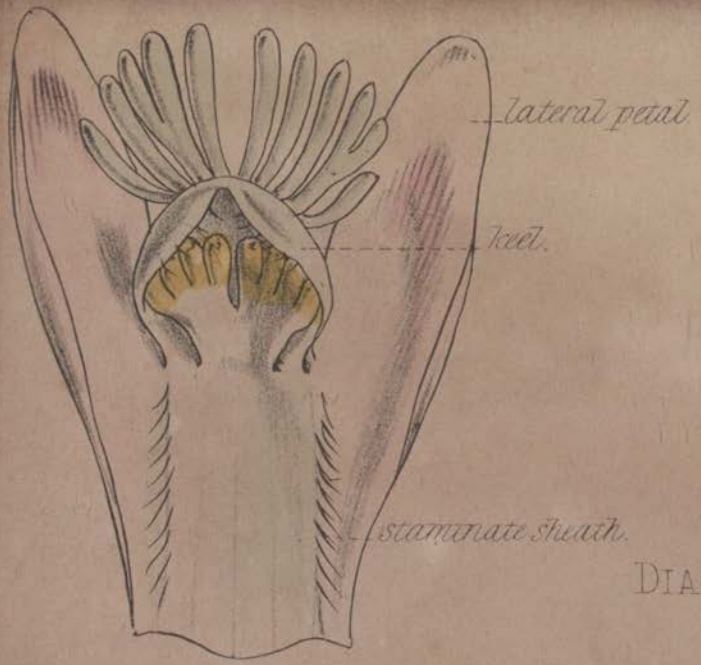


DIAGRAM OF FLOWER.

Fruit after dehiscence.

Violaceæ.



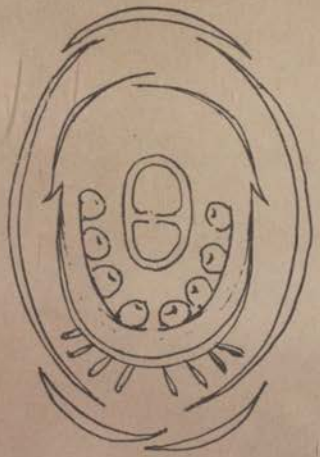
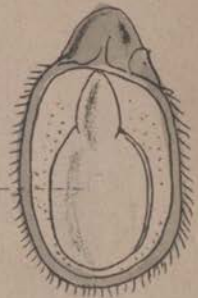
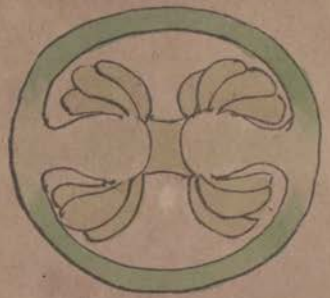


DIAGRAM OF FLOWER.



Polygalaceæ.



Transverse section of ovary.

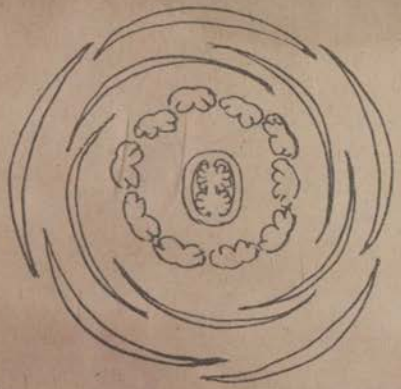
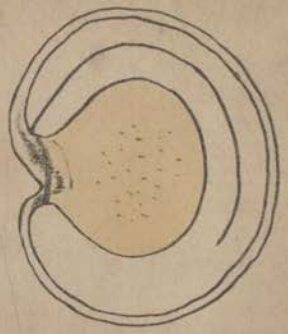
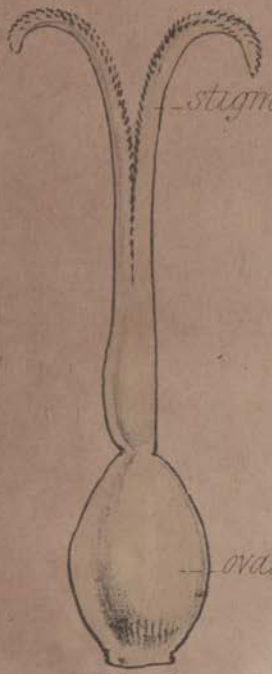


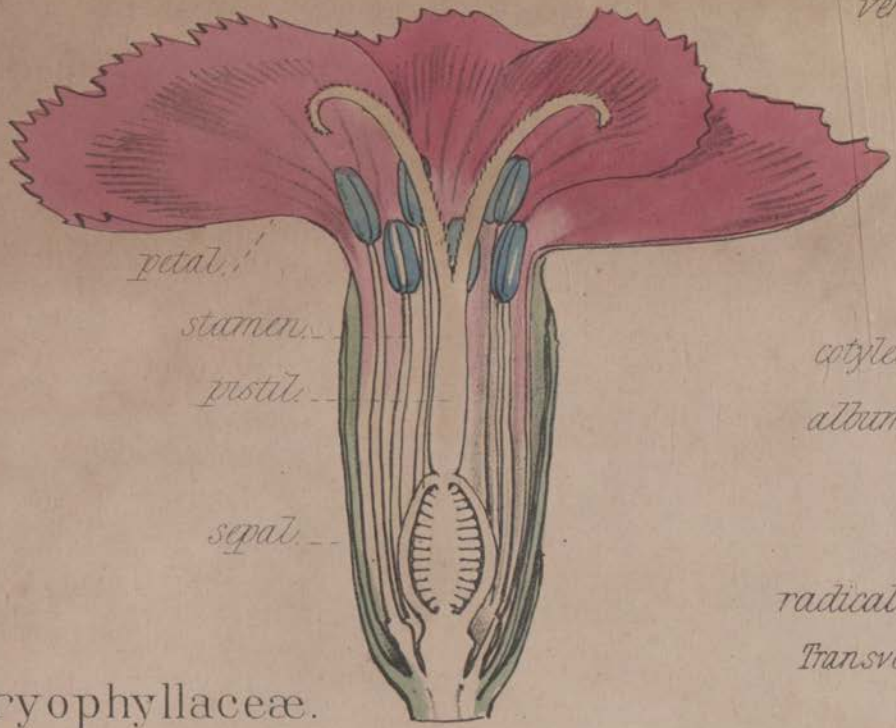
DIAGRAM OF FLOWER.



Seed of Saponaria vertical section.



Pistil.



Transverse section of seed.

Caryophyllaceæ.

petal.

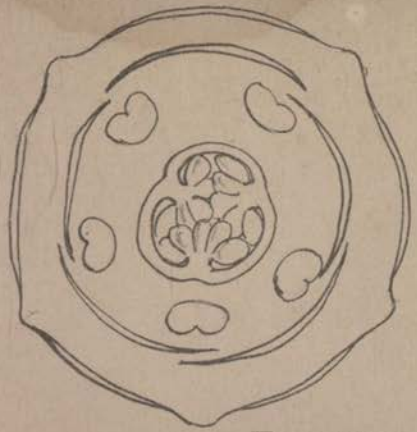
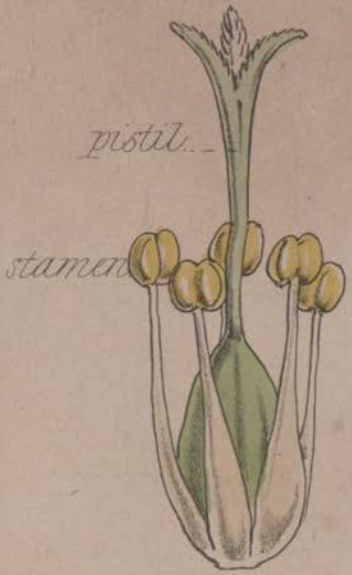


DIAGRAM OF FLOWER.

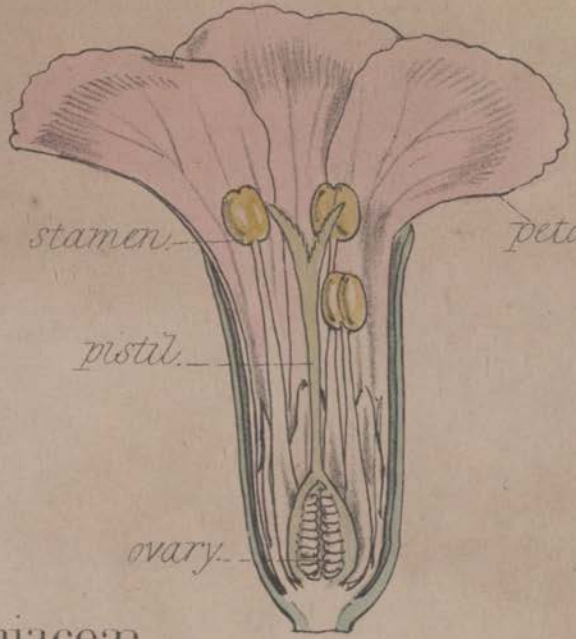
LIBRARY OF THE BOMBAY BRANCH OF THE ROYAL ASIATIC SOCIETY

pistil.



pistil.

stamen.



stamen.

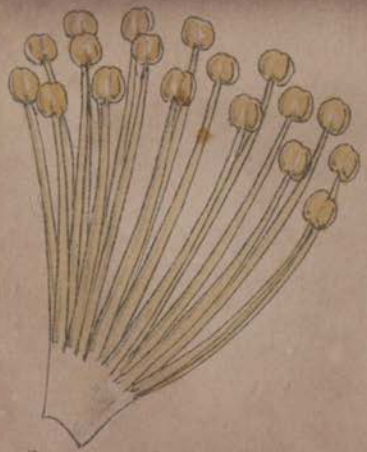
petal.

pistil.

ovary.

Capsule.

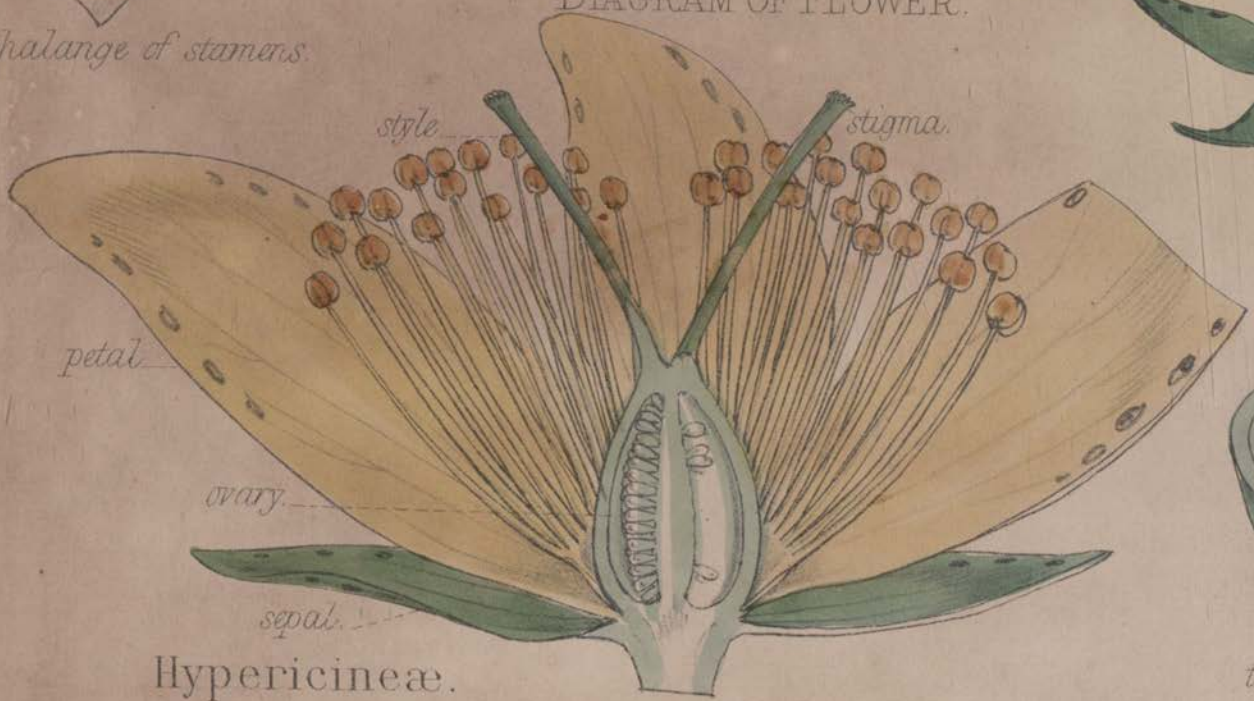
Frankeniaceæ.



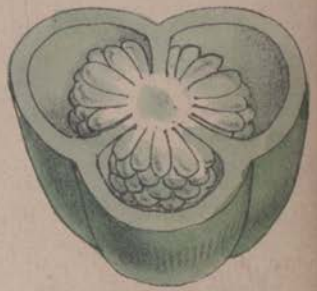
phalange of stamens.

DIAGRAM OF FLOWER.

fruit.

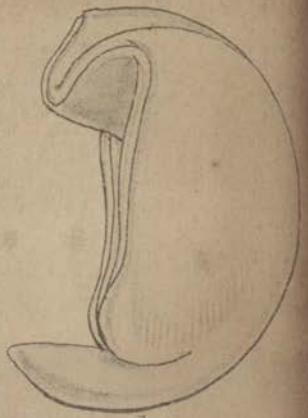


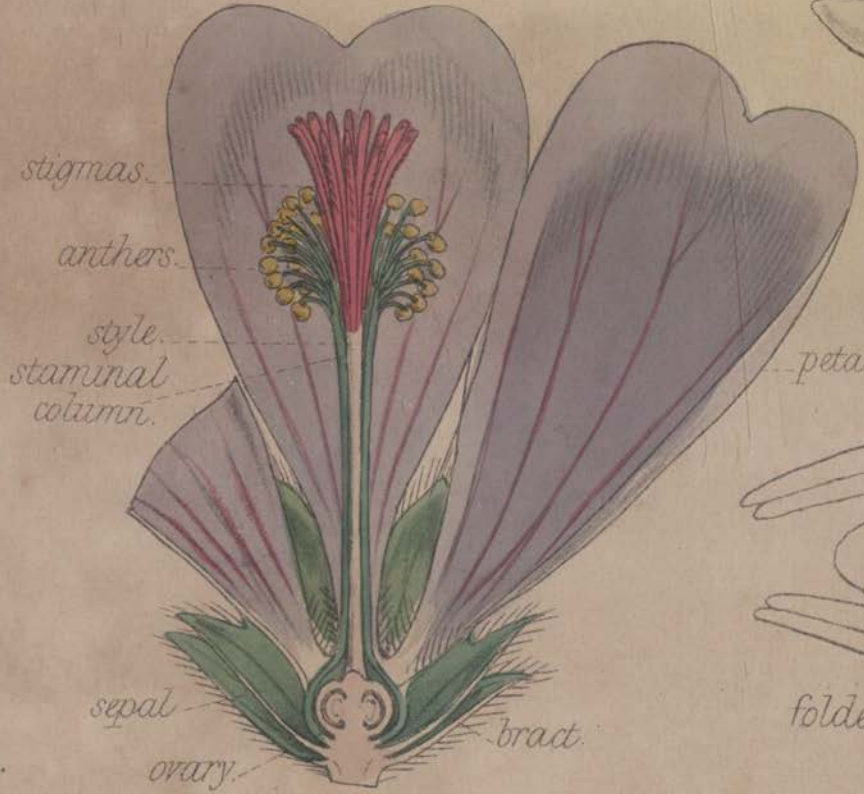
Hypericineæ.



transverse section of ovary.

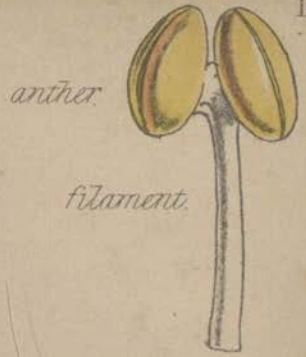
DIAGRAM OF FLOWER.

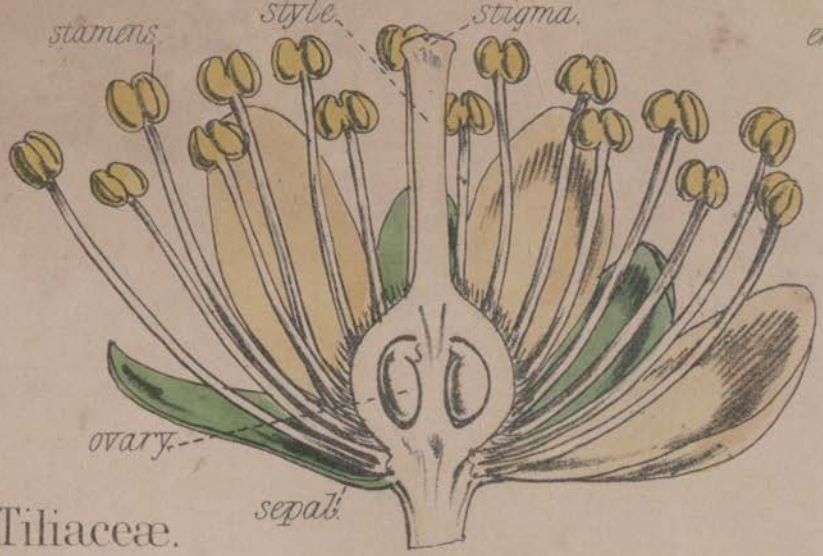




Malvaceæ.

DIAGRAM OF FLOWER.





Tiliaceæ.

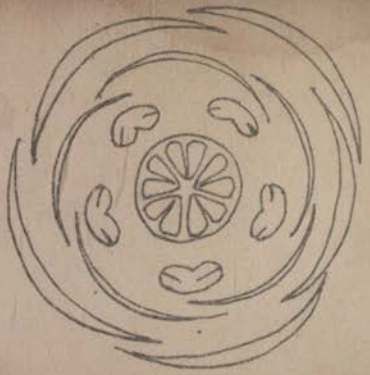
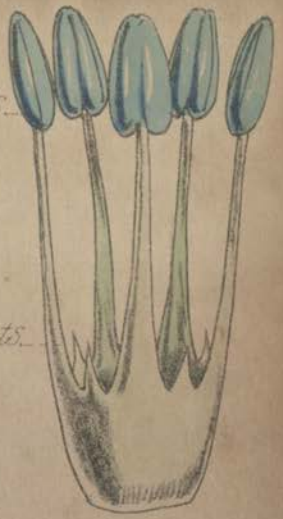
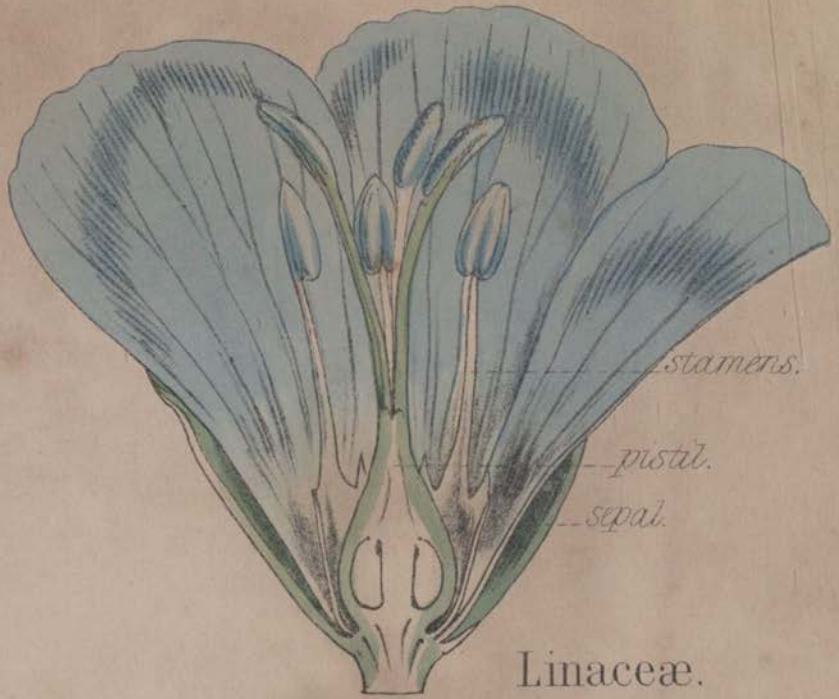
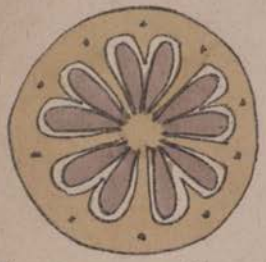


DIAGRAM OF FLOWER.







transverse section of fruit.

Linaceæ.

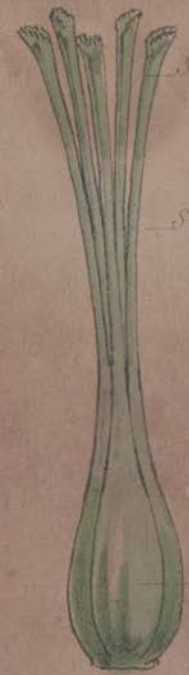
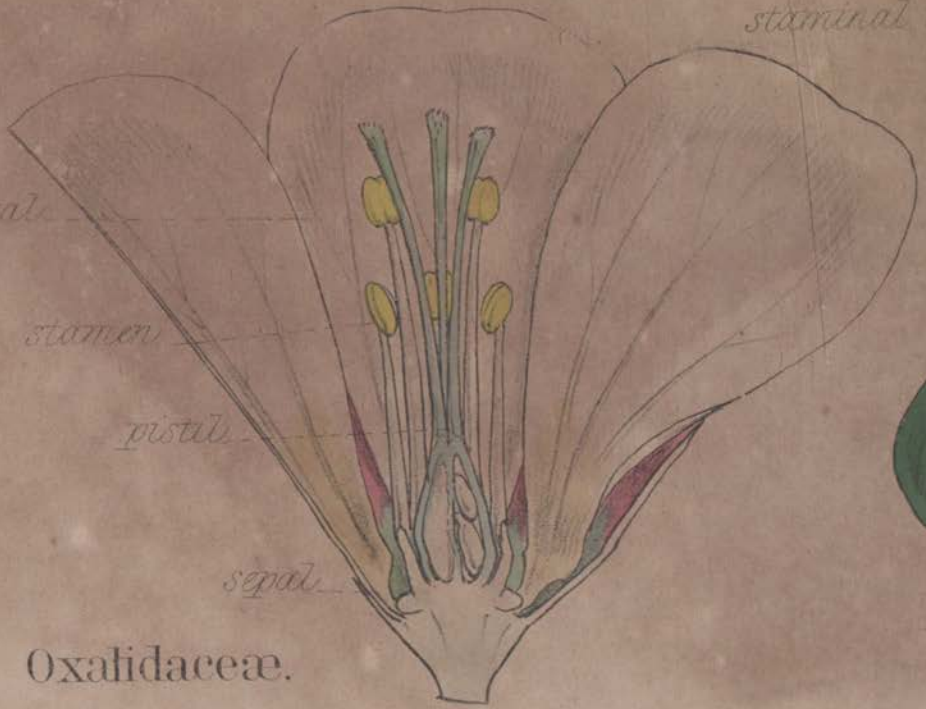


DIAGRAM OF FLOWER.

LIBRARY OF THE BOMBAY BRANCH OF THE ROYAL ASIATIC SOCIETY



Leaf awake

Leaf asleep

Oxalidaceæ.

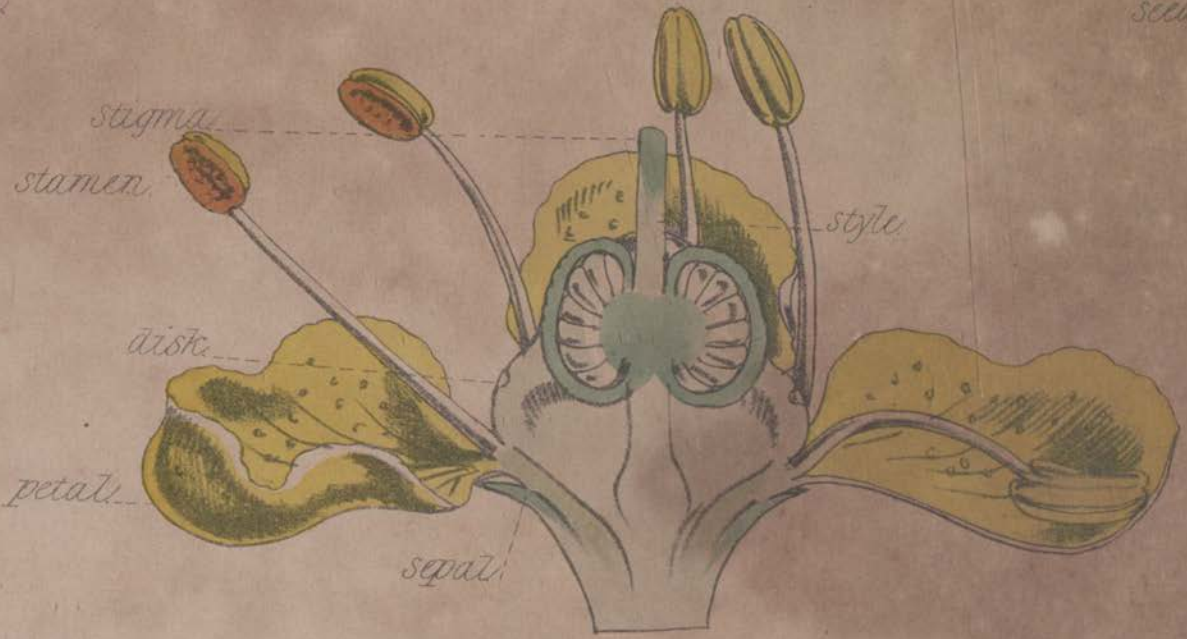
stigma
anther
style
ovary
filament
petal
stamen
pistil
seed.
ovule
calyx
DIAGRAM OF FLOWER.
carpels
beak
fruit
embryo

Geraniaceæ.

fruit

DIAGRAM OF FLOWER

seed



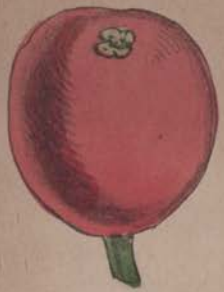
Rutaceæ.

barren flower

fertile flower.

stamens.

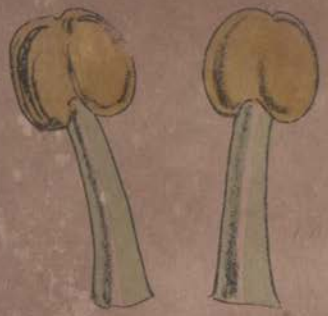
DIAGRAM OF FLOWER.



Fruit.

seed.

Ilicineæ.



stamens.

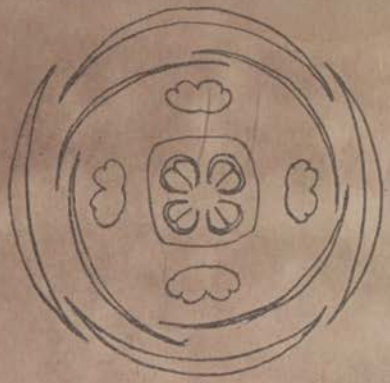
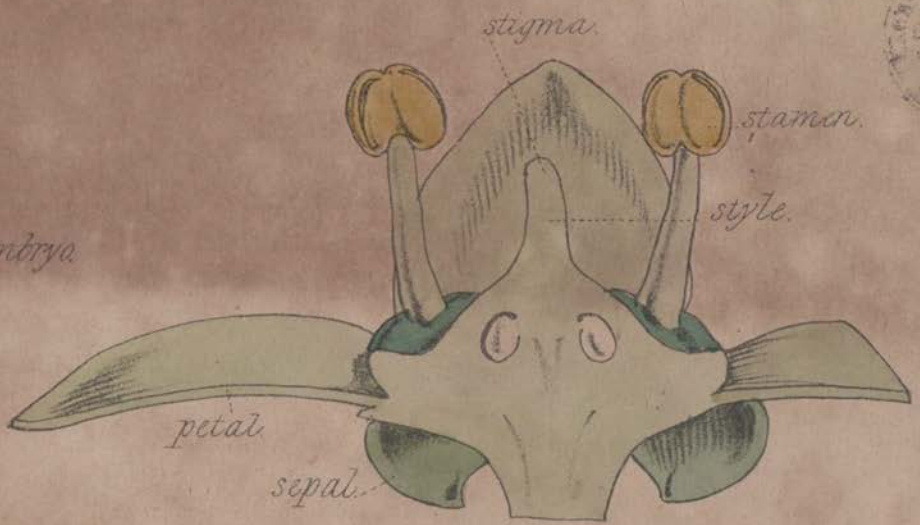


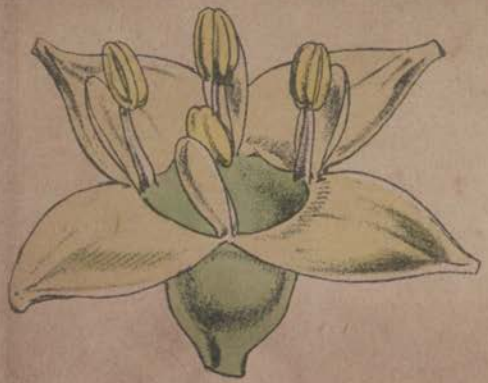
DIAGRAM OF FLOWER.

seed.
vertical section.



seed
transverse section

Celastraceæ.



flower

DIAGRAM OF FLOWER.

LIBRARY OF THE BOMBAY BRANCH OF THE ROYAL ASIATIC SOCIETY

stamen

berry

seed

Rhamnaceæ.

flower bud.

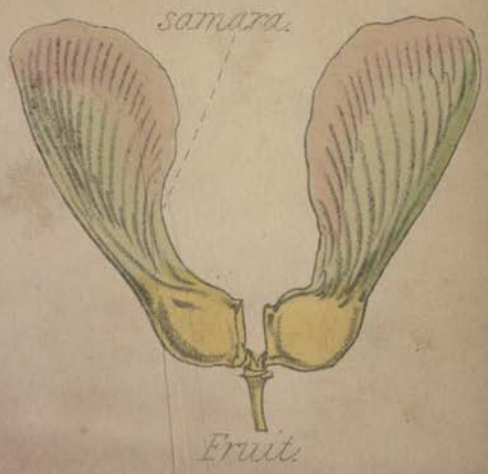
DIAGRAM OF FLOWER

fruit.

seed.

Ampelideæ.

DIAGRAM OF FLOWER.



Acerineæ.

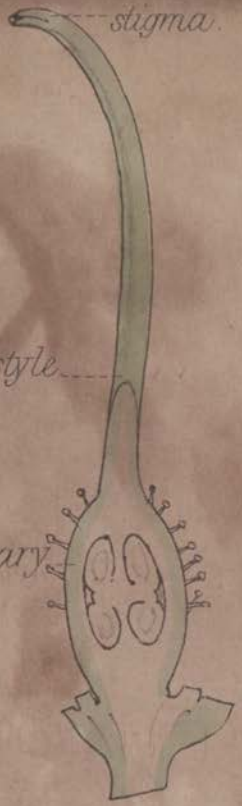
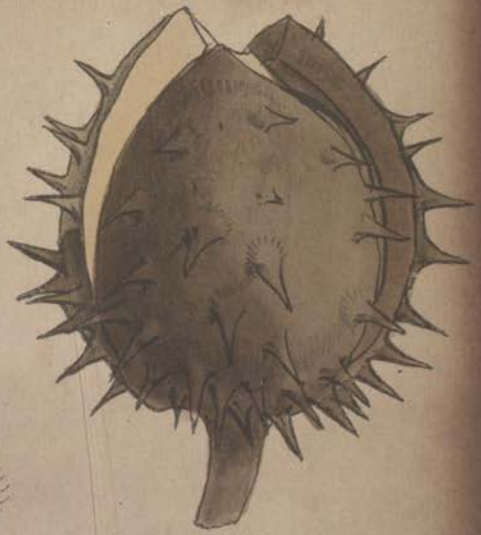
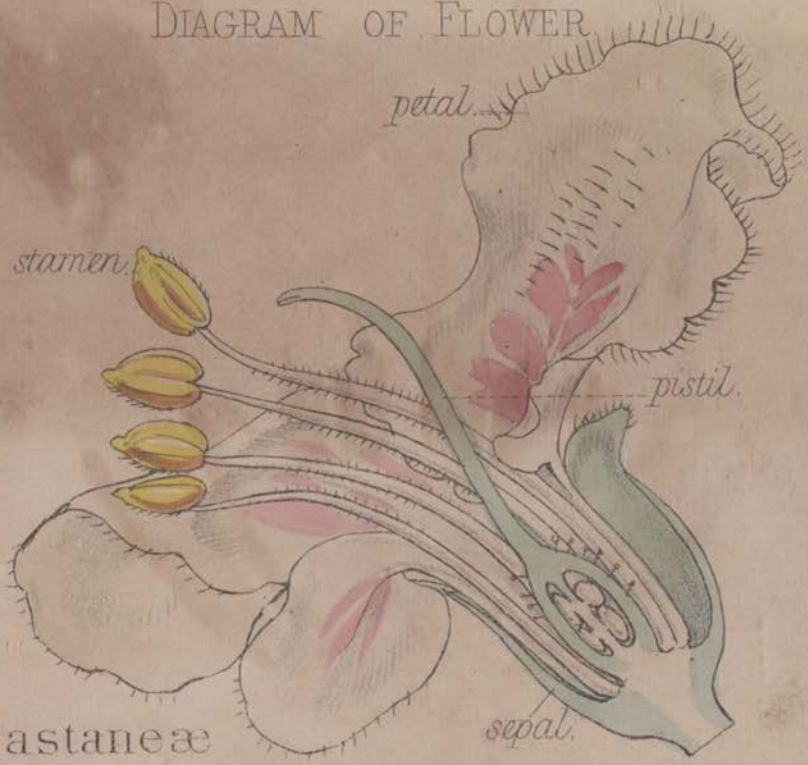
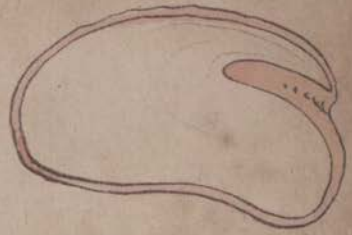


DIAGRAM OF FLOWER.



fruit dehiscing.





vertical section of seed.

Hippocastaneæ

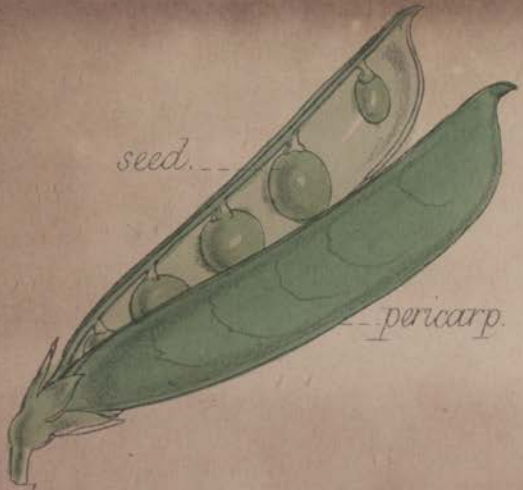
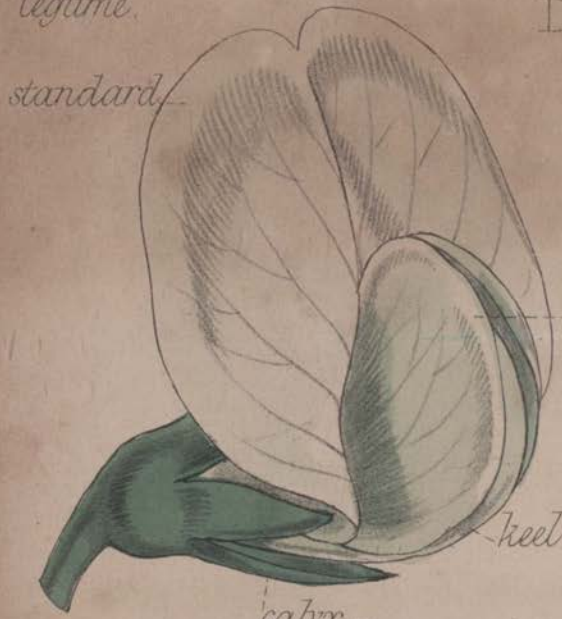


DIAGRAM OF FLOWER.

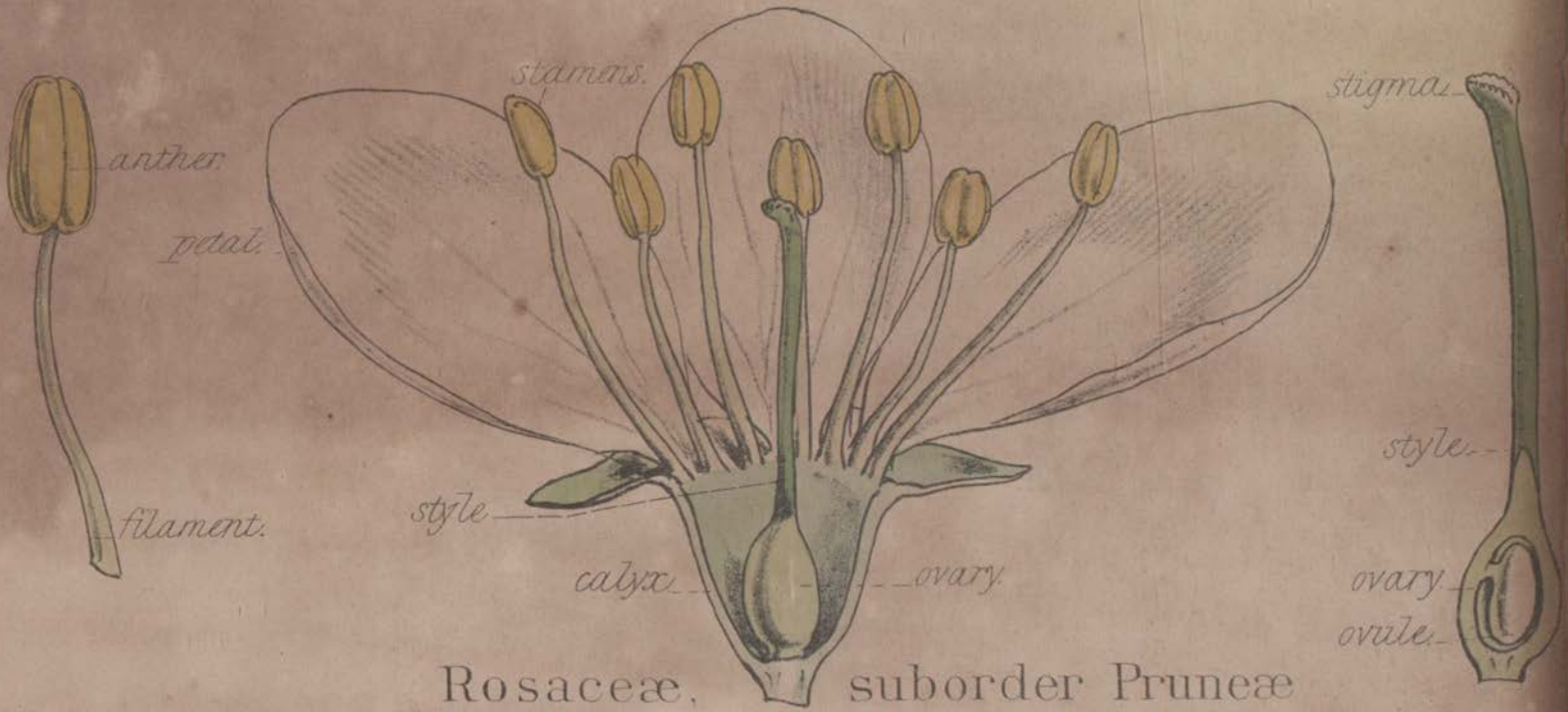


Leguminosæ.

Endocarp of Peach.

DIAGRAM OF FLOWER.

Fruit of Sloe.



Rosaceæ, suborder Pruneæ

calyx & epicalyx of Strawberry.

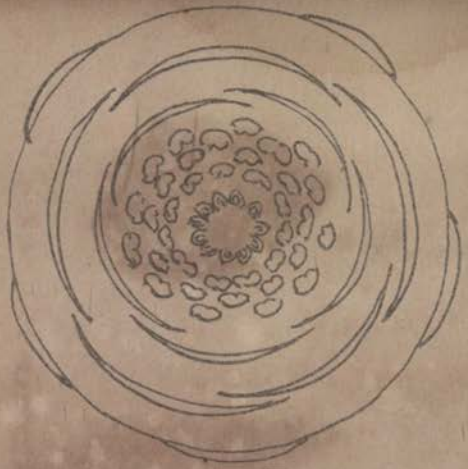


DIAGRAM OF FLOWER.

Fruit.

seed.

Rosaceæ. suborder Dryadeæ.

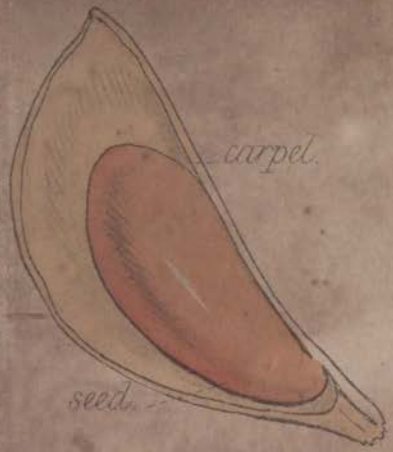
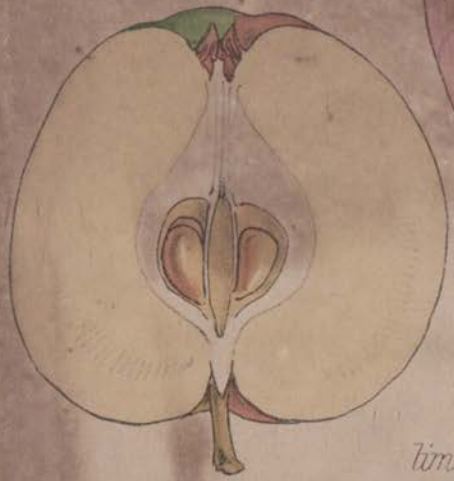
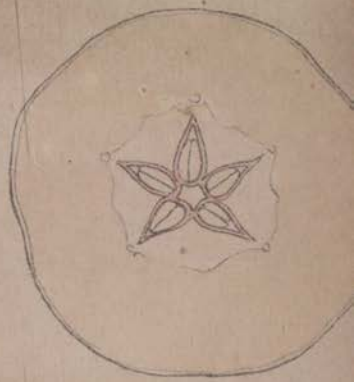
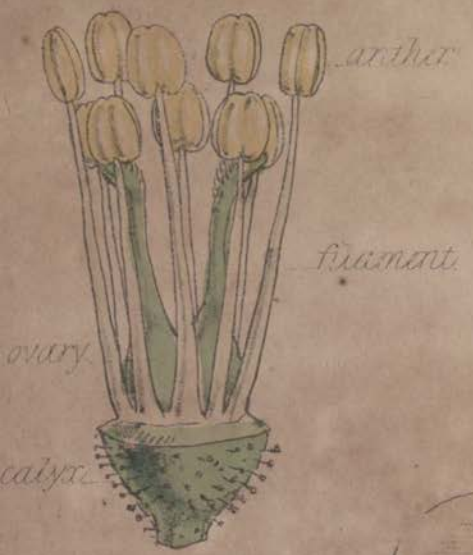


DIAGRAM OF FLOWER.





Rosaceæ, suborder Pomeæ.



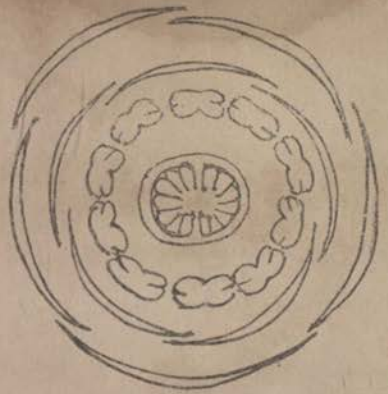
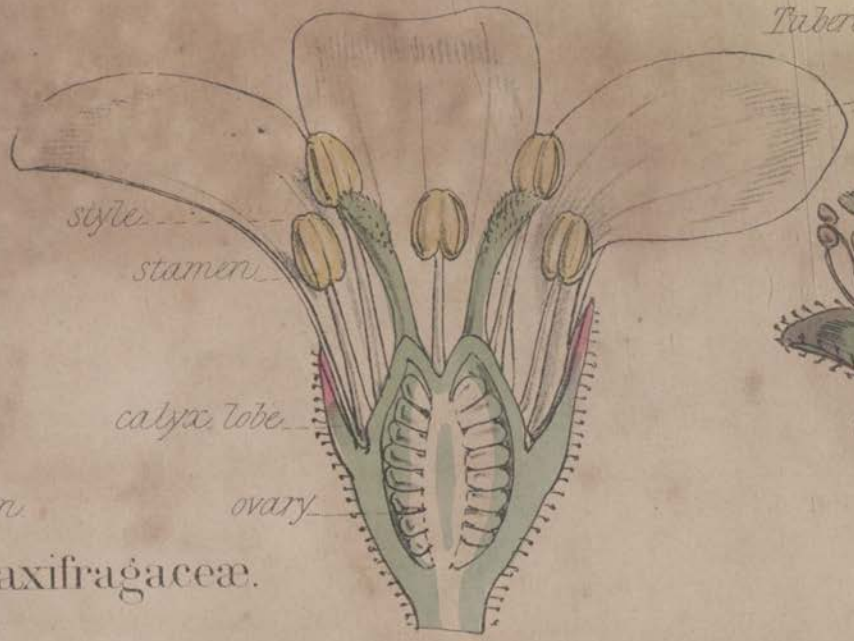


DIAGRAM OF FLOWER.



Saxifragaceæ.

raceme of flowers

DIAGRAM OF FLOWER.

raceme of fruit

Ribesiaceæ.

DIAGRAM OF FLOWER.

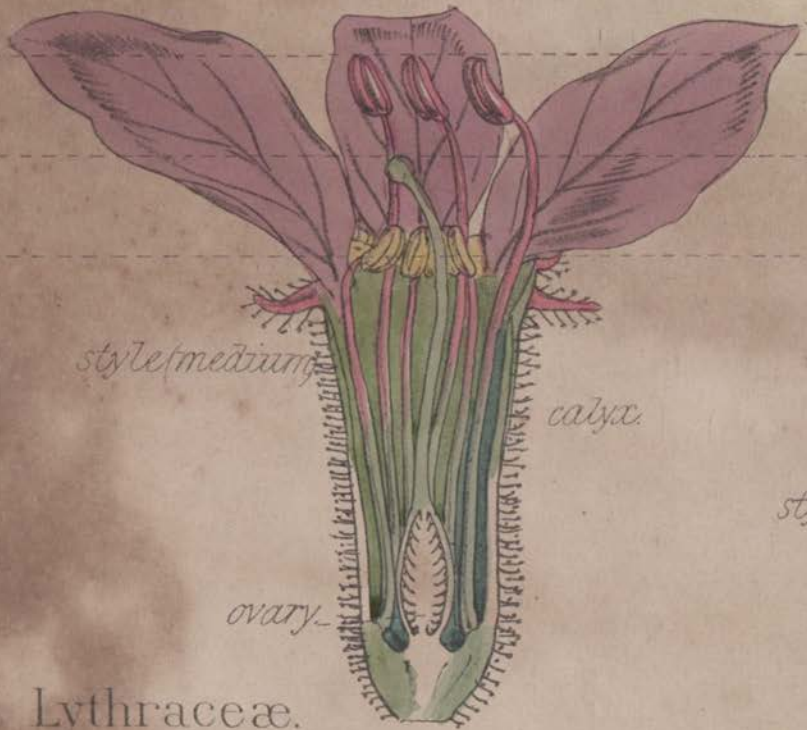
Crassulaceæ.

DIAGRAM OF FLOWER.

Droseraceæ.

Capsule

DIAGRAM OF FLOWER.



Lythraceæ.

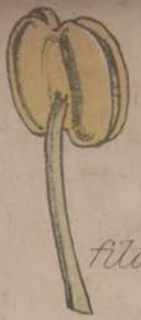
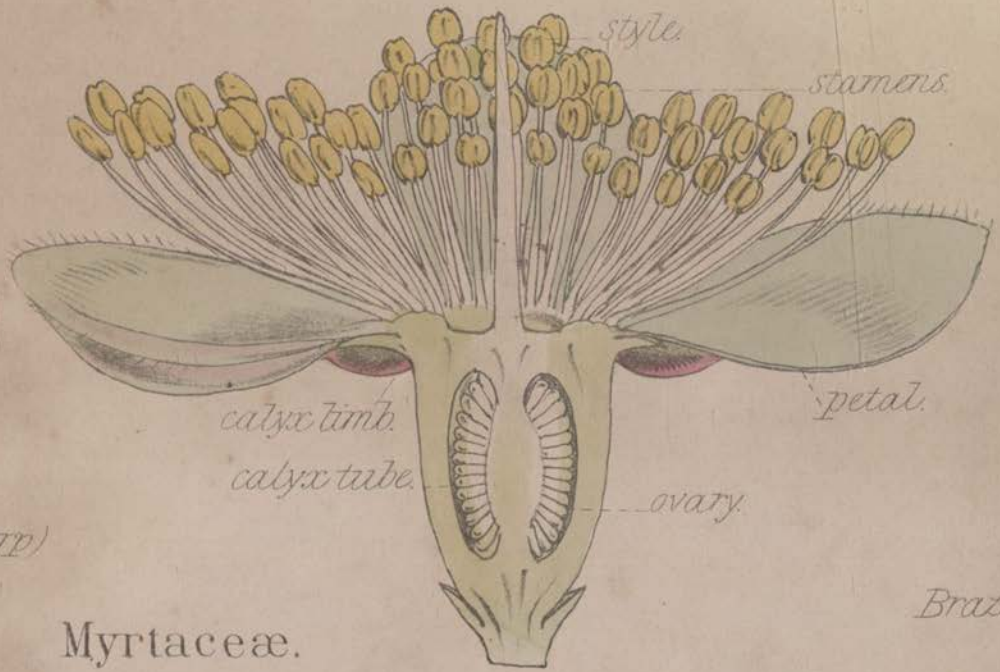


DIAGRAM OF FLOWER.



Brazil nut (Pericarp) (reduced)

Brazil nut (Seed)

Myrtaceæ.

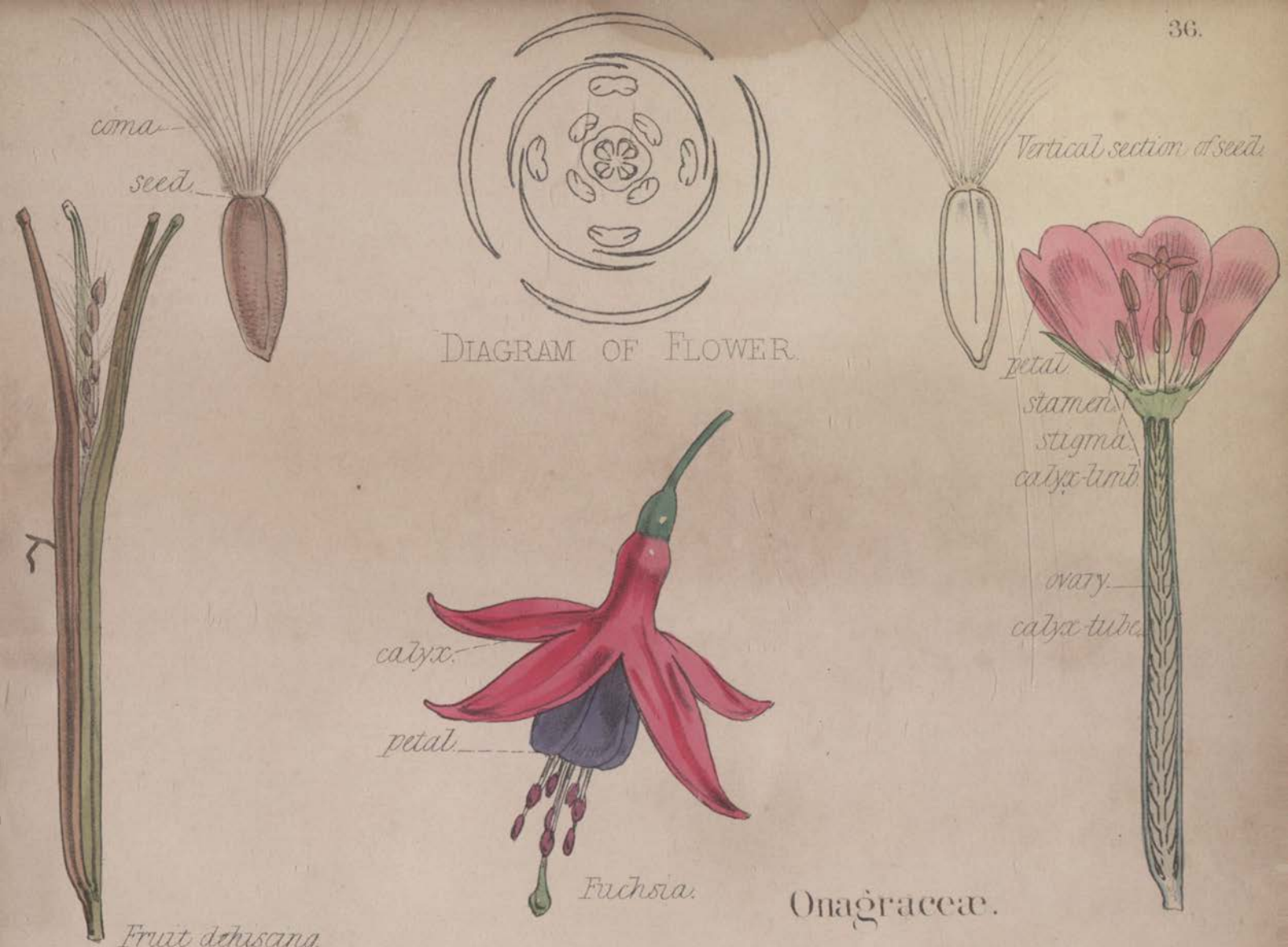


DIAGRAM OF FLOWER.

Fruit dehiscang.

Fuchsia.

Onagraceæ.

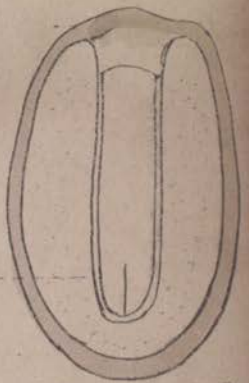
Callitriche
(pistillate flower)

DIAGRAM OF FLOWER.

fruit of Trapa.

Callitriche (staminate flower)

Hippuris.



vertical section of fruit

Haloragæ.

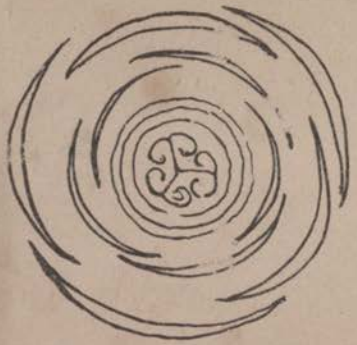


DIAGRAM OF
PISTILLATE FLOWER.

staminate flower.

DIAGRAM OF
STAMINATE FLOWER.

ovary.

pistillate flower.

Cucurbitaceæ.

transverse section of ovary.

DIAGRAM OF FLOWER.

fruit.

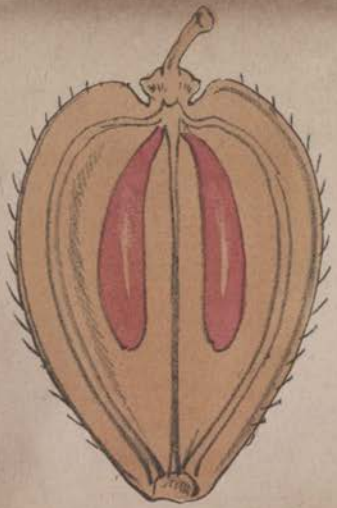
aril.

seed.

stigma.
anther.
ovary.
corona.
~~gynophore~~
gynandrophore
calyx tube.

stamen

Passifloraceæ.

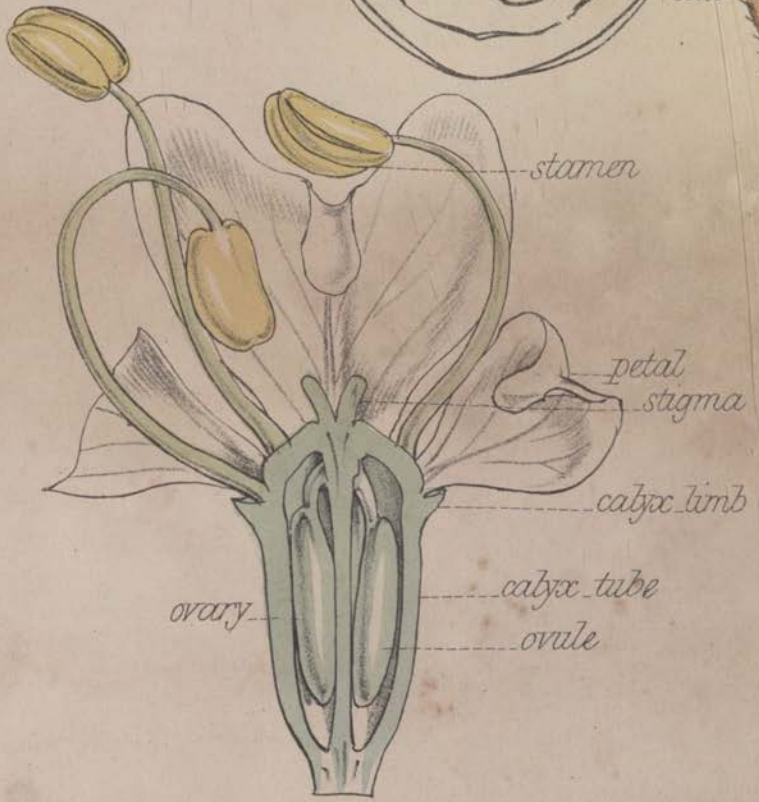


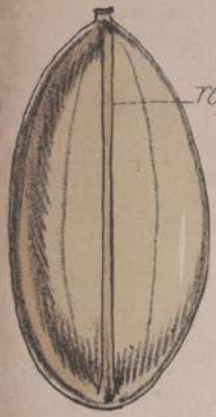
Fruit carpel (front)

DIAGRAM OF FLOWER.

vitta

Fruit carpel. (back)





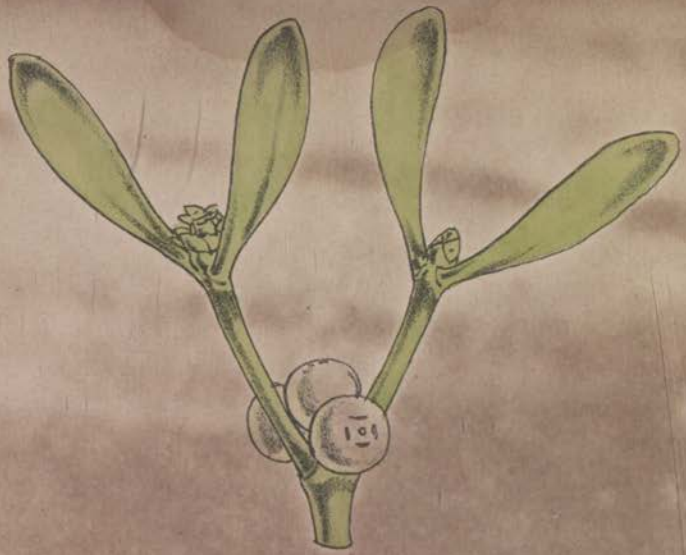
seed.

embryo

Carpophore

Umbelliferæ.

Staminate flower.



Fruit.

Pistillate flower.

Multilocellate anthers.

vertical section of fruit.

vertical section of inferior ovary.

Loranthaceæ.

flower.

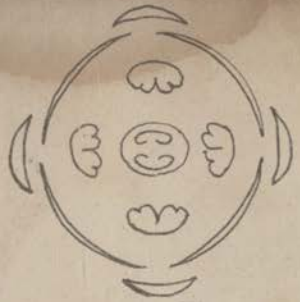
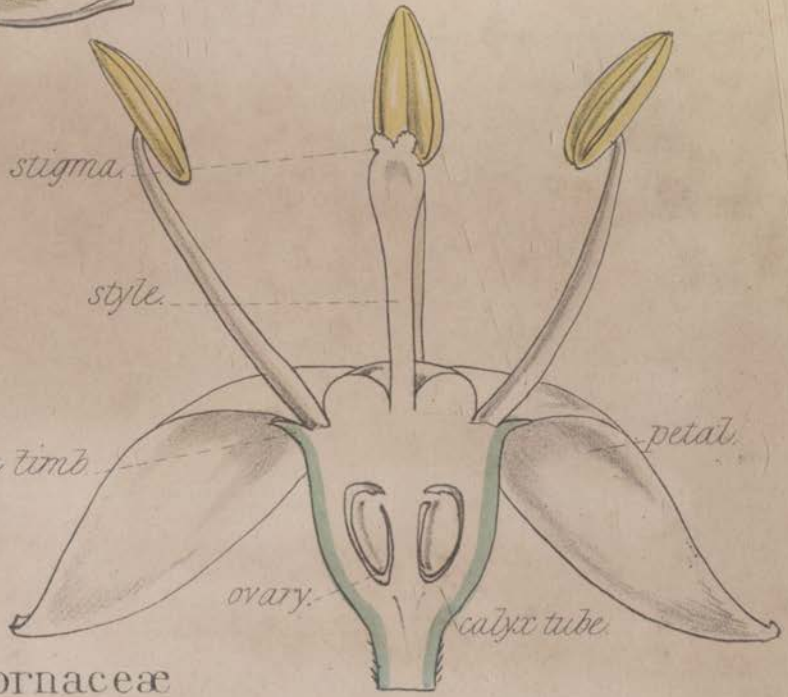
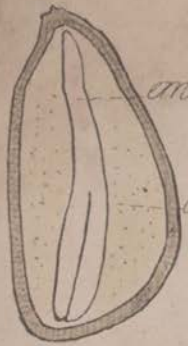


DIAGRAM OF FLOWER.

pistil & adherent calyx.





vertical section of seed.

fruit

Cornaceæ

mature fruit

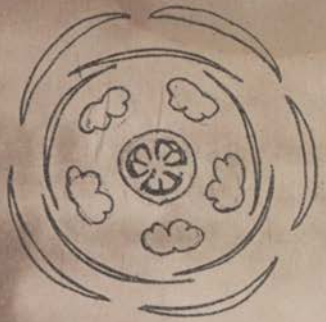


DIAGRAM OF FLOWER.

fertile flower of Guelder Rose

anther

filament

stigma

stamen

corolla

style

calyx limb

calyx tube

ovary

neuter flower of Guelder Rose

Caprifoliaceæ.

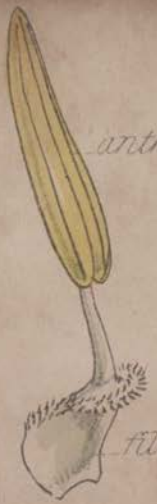


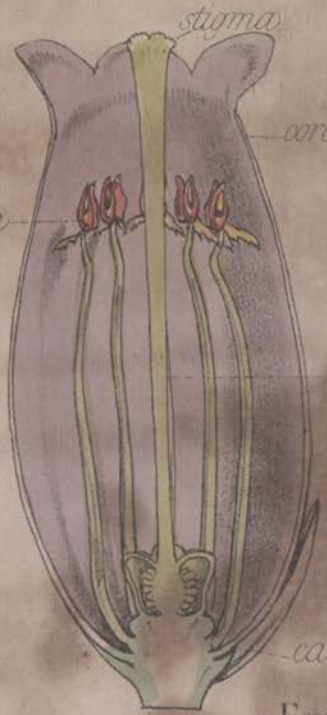
DIAGRAM OF FLOWER.

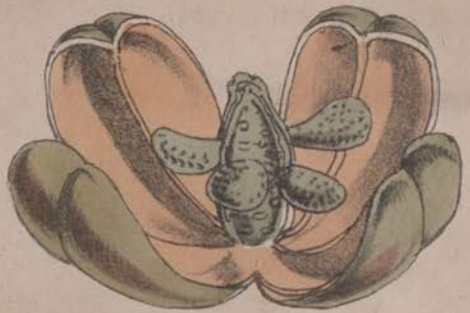
transverse section of ovary.

calyx of Canterbury Bell.

Campanulaceæ.

DIAGRAM OF FLOWER.

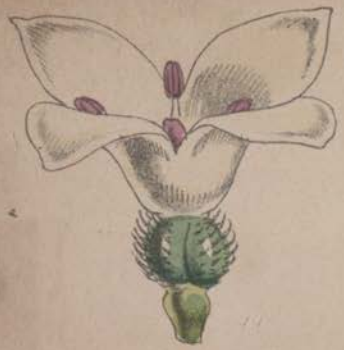




fruit dehisang.

leaves.

Ericaceæ.



flower.

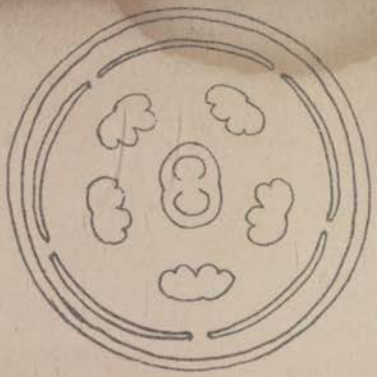
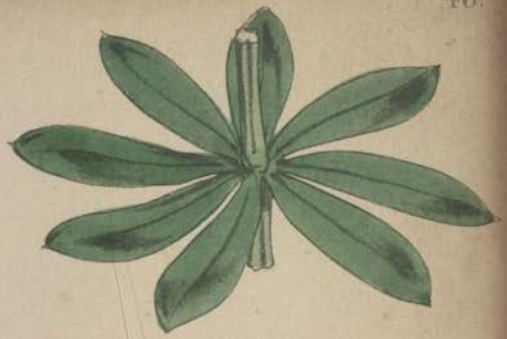
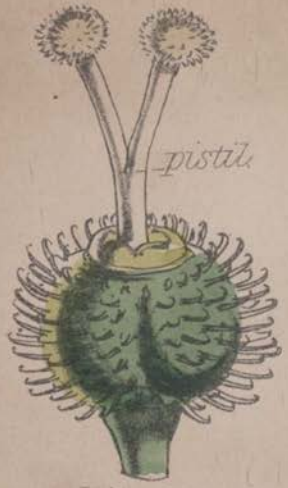
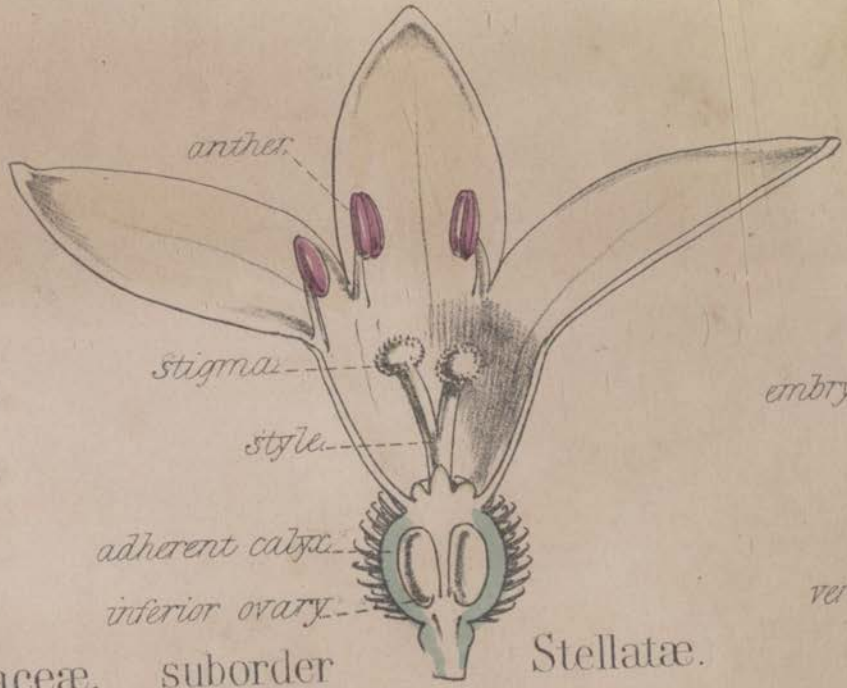


DIAGRAM OF FLOWER.



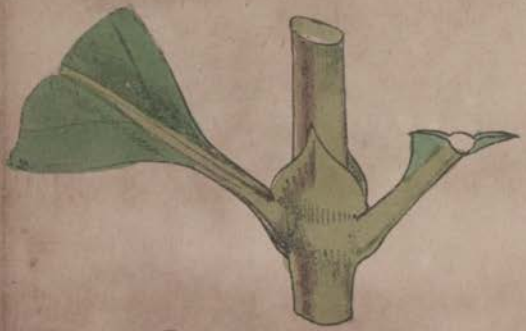
whorl of leaves.





vertical section of seed.

Rubiaceæ, suborder Stellatæ.



Intapetiolar Stipule.

transverse.

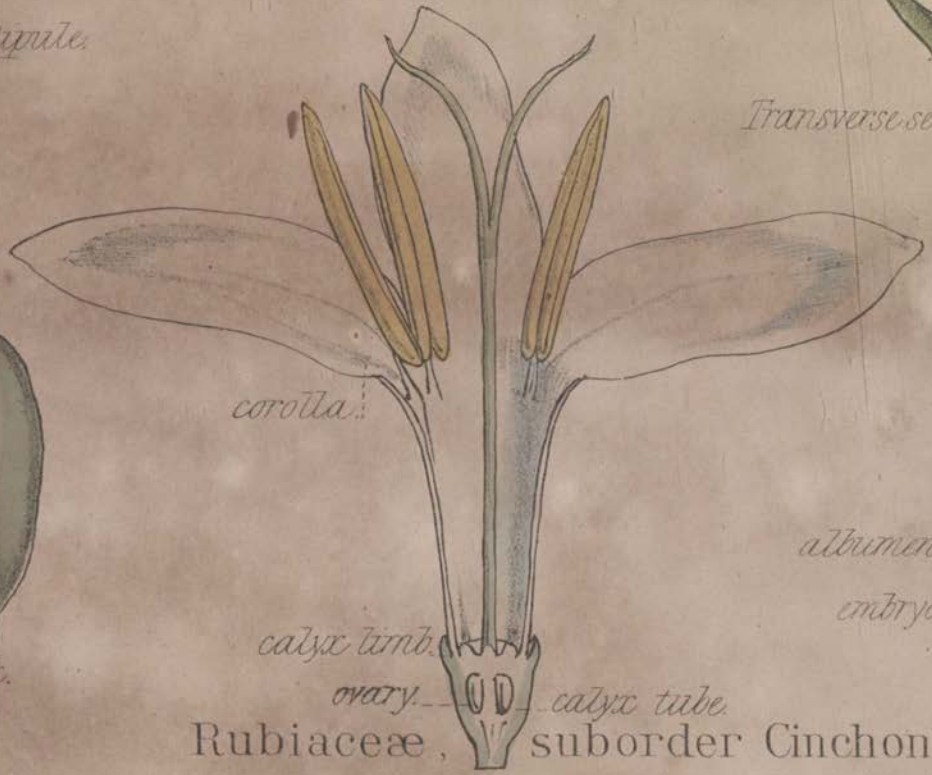
front.

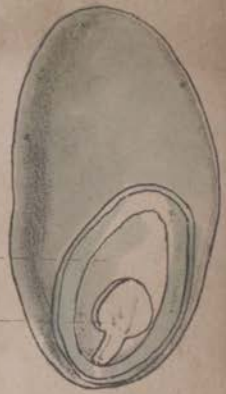
back.

Seed.

DIAGRAM OF FLOWER.

Transverse section of ovary.





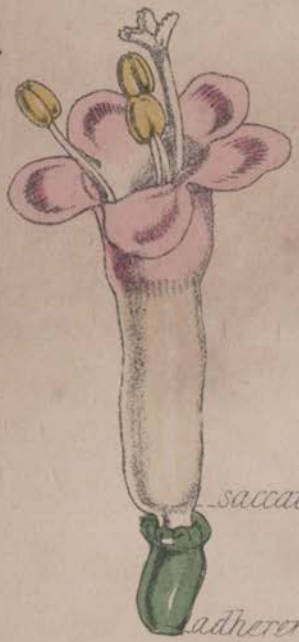
Seed.

Rubiaceæ, suborder Cinchonaceæ.

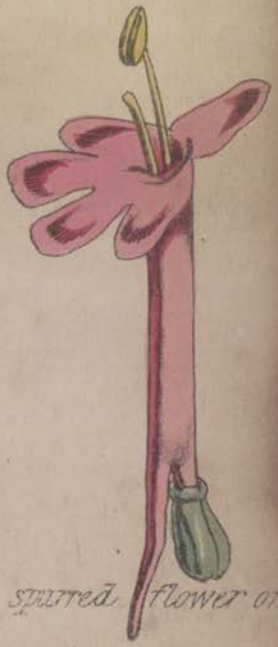
mature fruit

DIAGRAM OF FLOWER.

immature fruit



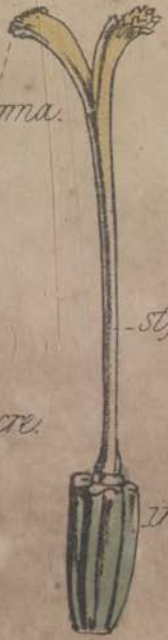
Valerianaceæ.

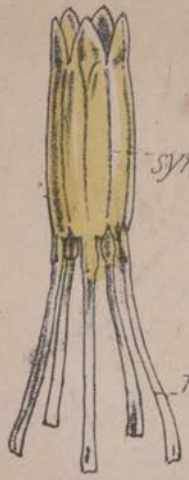


spurred flower of Centranthus

DIAGRAM OF SCABIOSA.

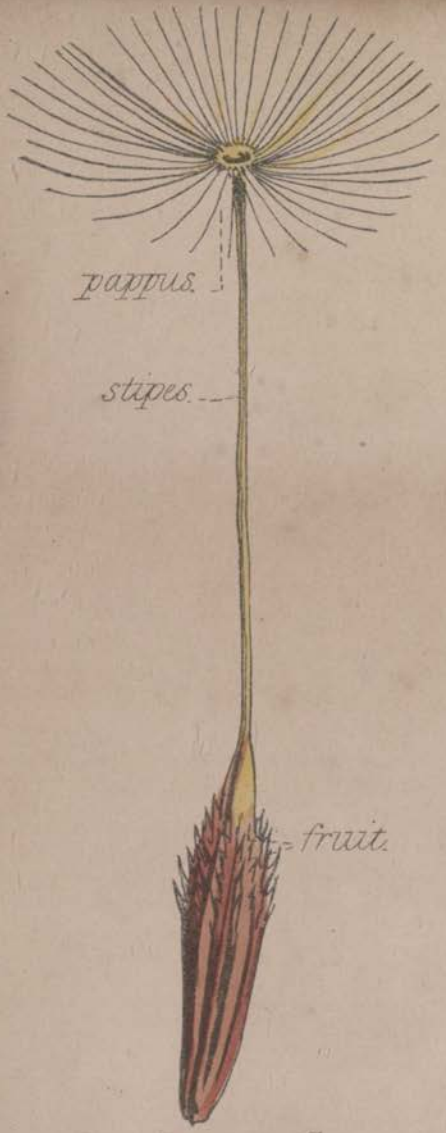
Dipsaceæ.





Compositæ, suborder Corymbiferæ.

Compositæ, suborder Cynareæ.



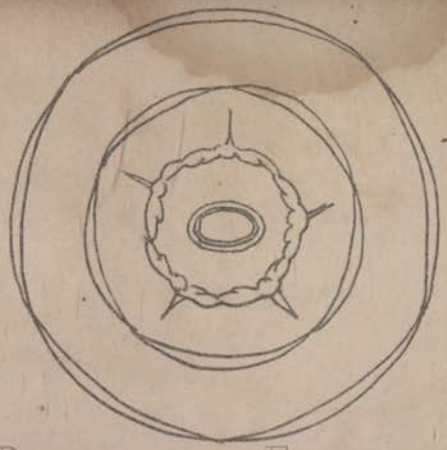
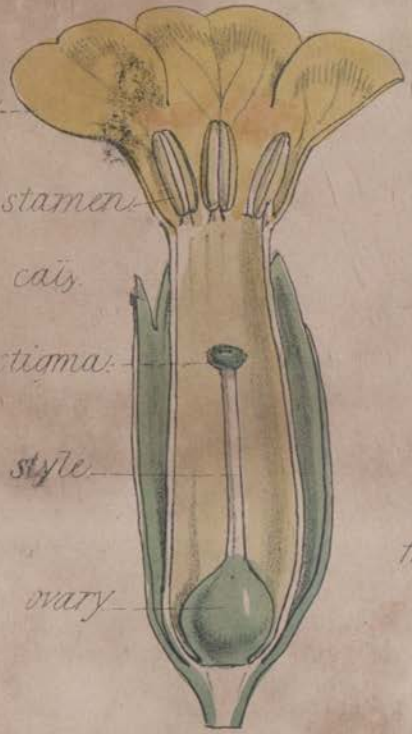


DIAGRAM OF FLOWER.

Compositæ, *Capitulum.* suborder Ligulifloræ.

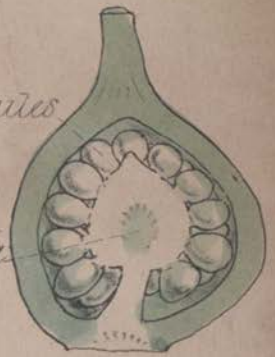
long-styled flower

DIAGRAM OF FLOWER.



short-styled flower

seed

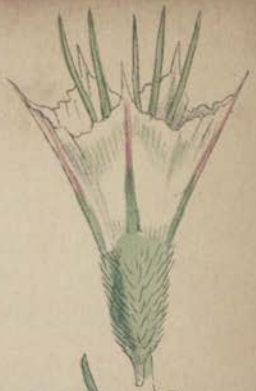


Vertical section of ovary.

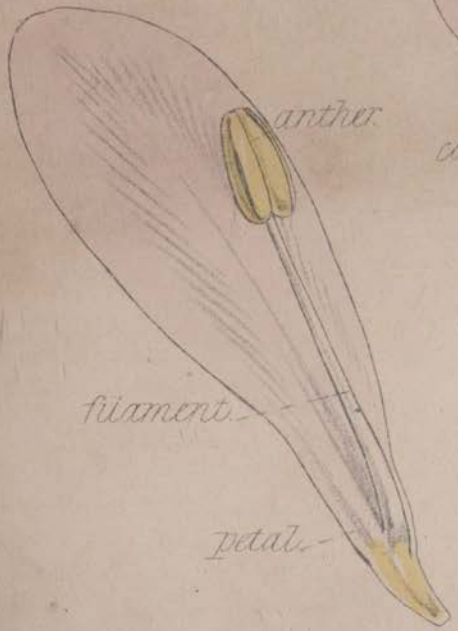
Primulaceæ.

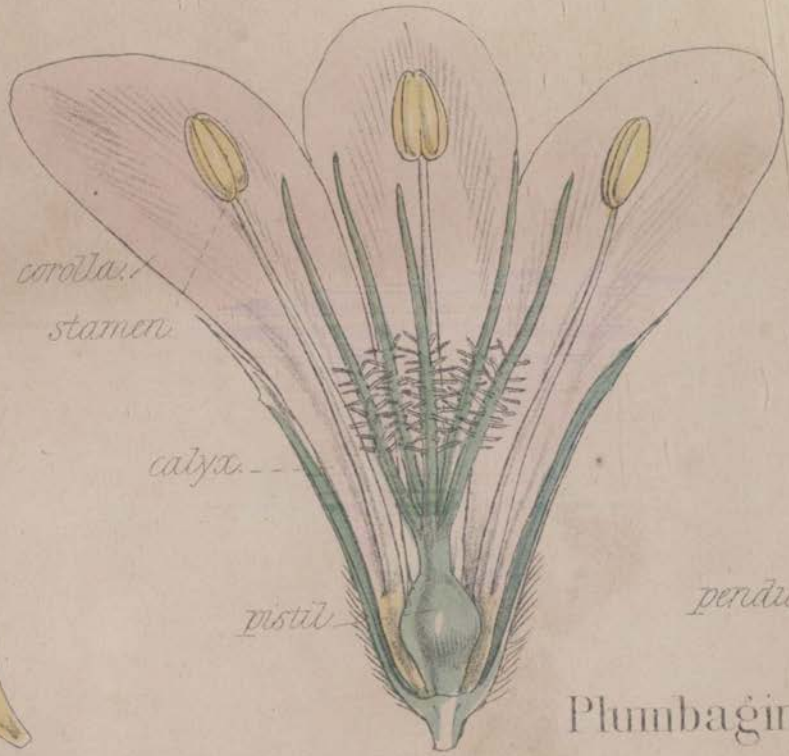
Flower

DIAGRAM OF FLOWER.

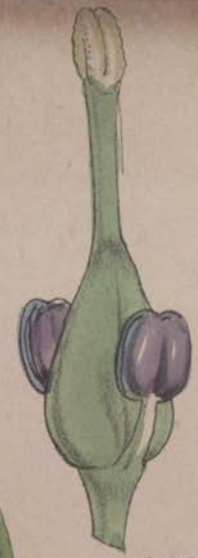


calyx





Plumbaginaceæ.



pistillate flower.

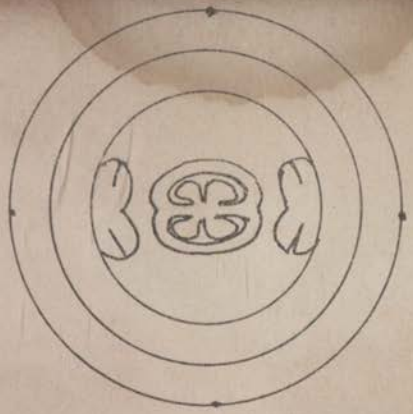
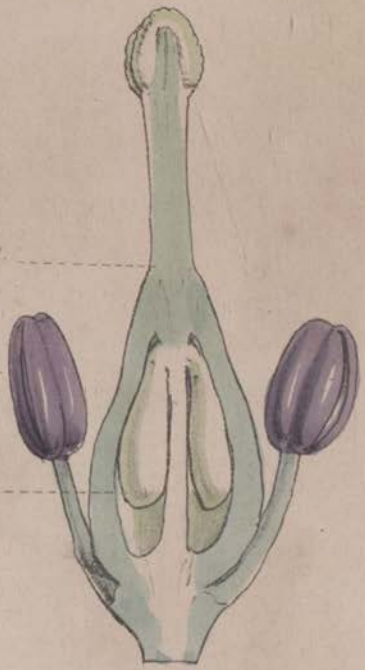


DIAGRAM OF PERFECT FLOWER.

staminate flower.

fruit.



Oleaceæ.

vertical section of fruit.

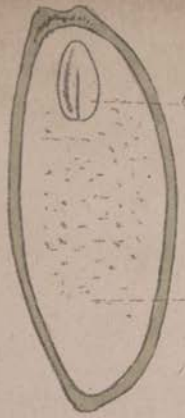


DIAGRAM OF FLOWER.

Gentianaceæ.

DIAGRAM OF FLOWER.

Apocynaceæ.

pollen of Periploca.

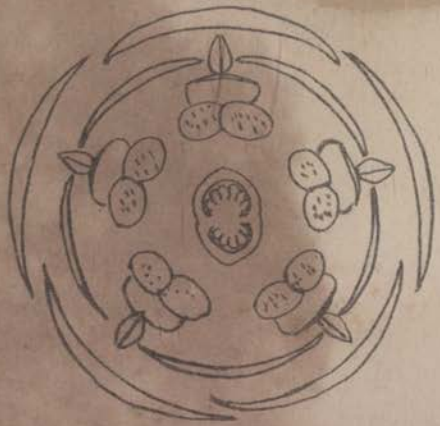
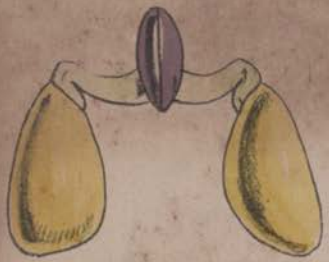


DIAGRAM OF FLOWER.

flower.

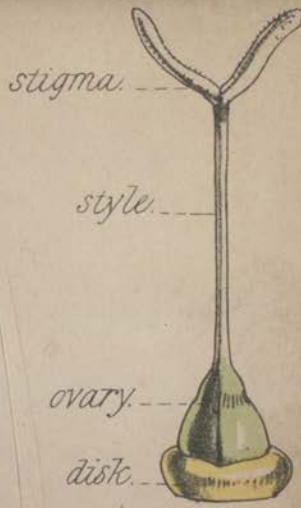


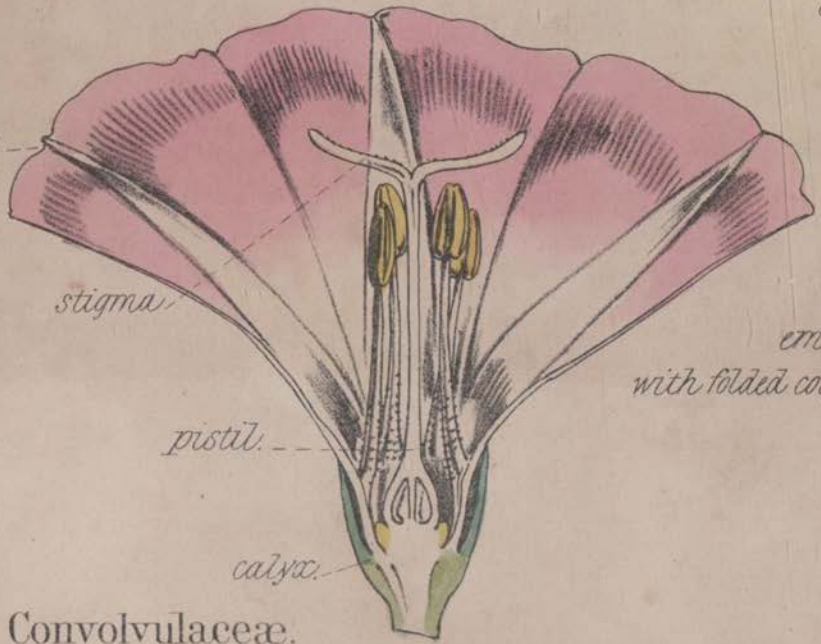
pollinium of Asclepias.

pollinium of Stapelia.

Asclepiadaceæ.

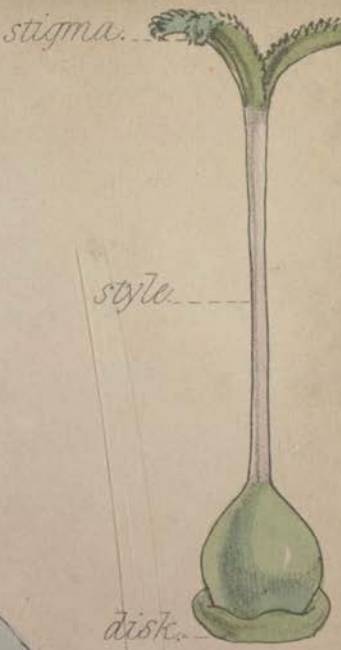
DIAGRAM OF FLOWER.

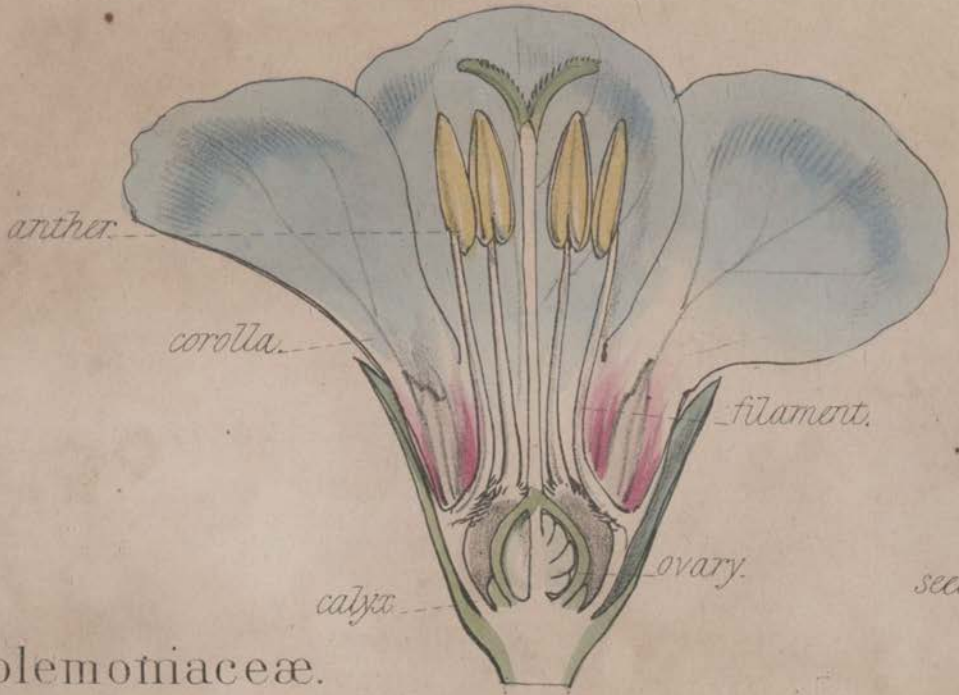


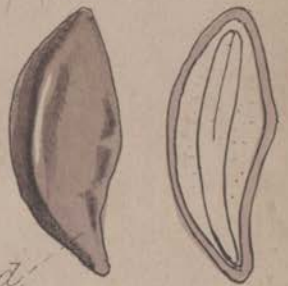


Convolvulaceæ.

DIAGRAM OF FLOWER.







Polemoniaceæ.

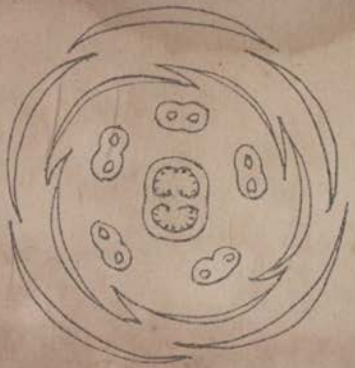
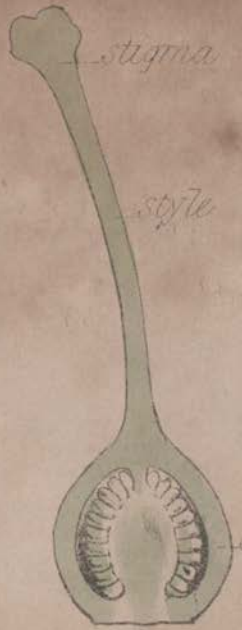
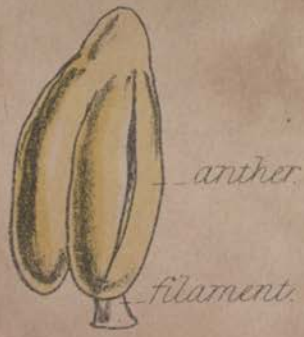


DIAGRAM OF FLOWER.



Solanaceæ



stamen.

DIAGRAM OF FLOWER

fruit.

flower.

Boraginaceæ.

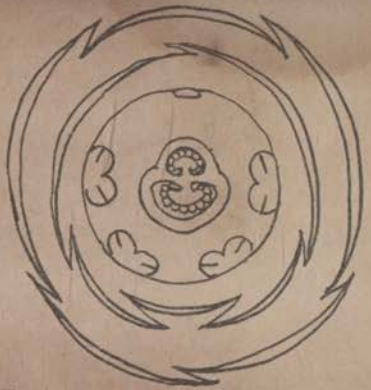
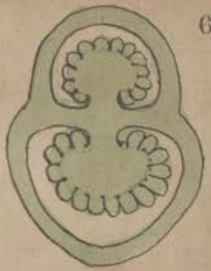
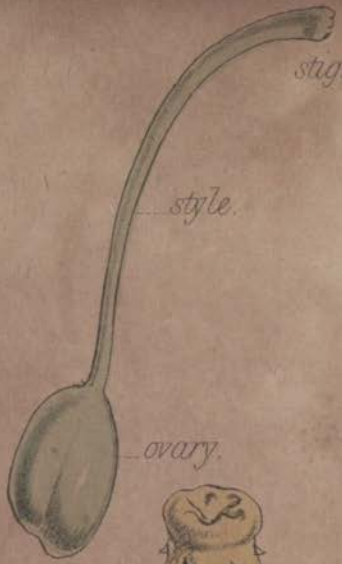
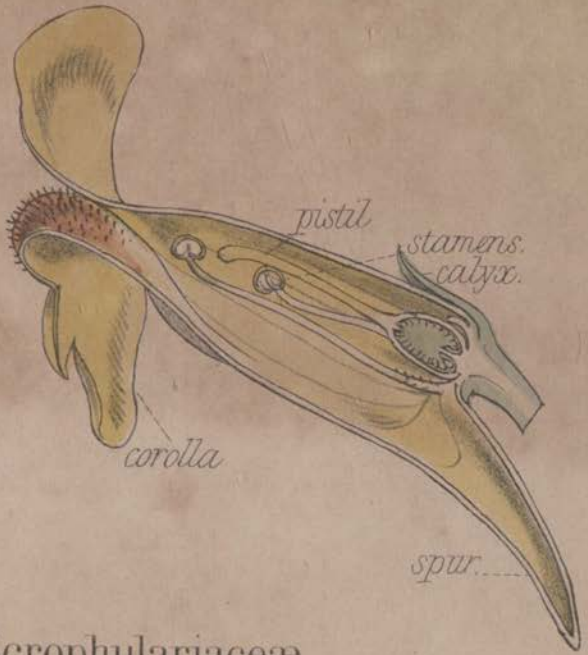


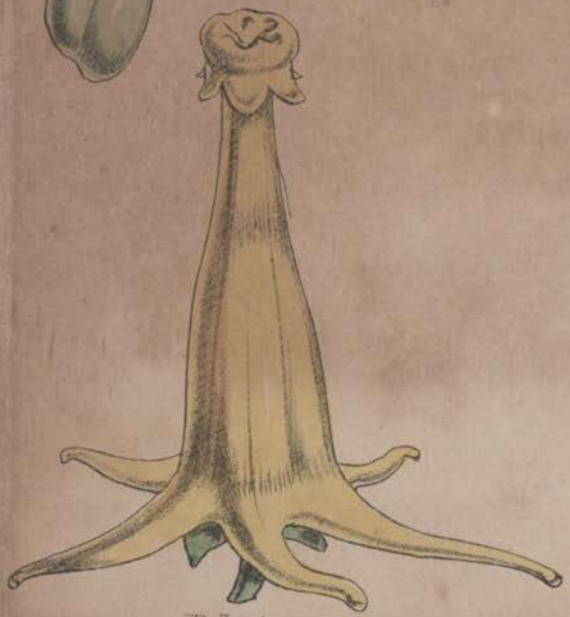
DIAGRAM OF FLOWER.



transverse section of two-celled ovary.







Peloria.

Scrophulariaceæ.

Lentibularieæ.

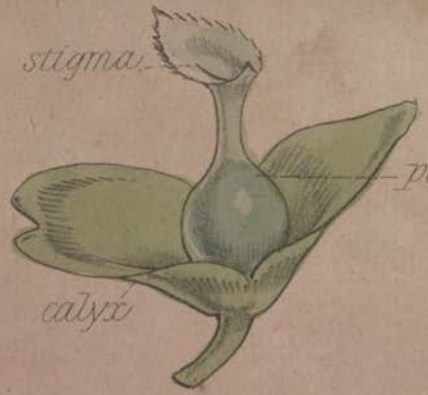
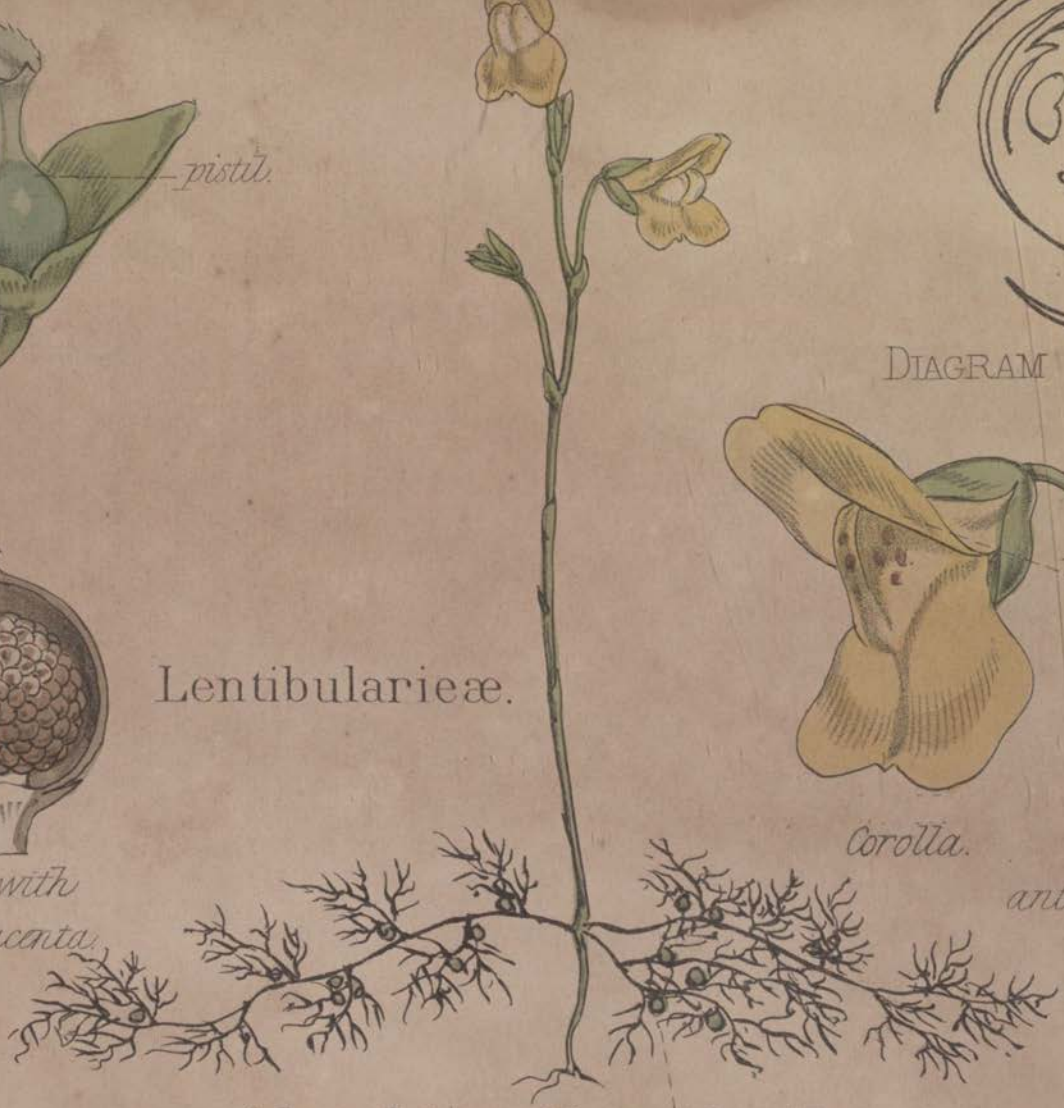


DIAGRAM OF FLOWER.

Corolla.

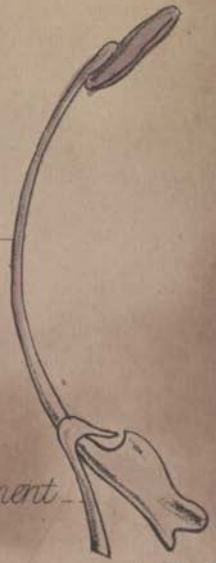
open fruit with free central placenta.

Stamen.



Submerged dissected leaves with vesicles.

DIAGRAM OF FLOWER.



Labiatæ.

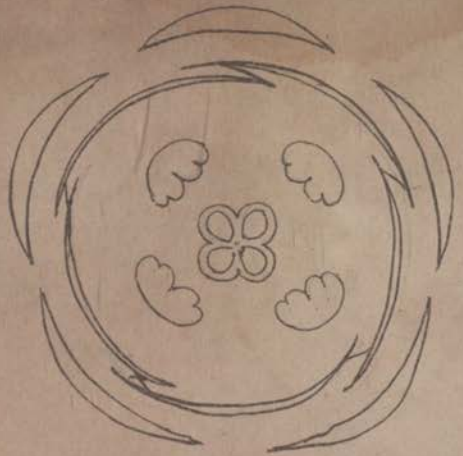


DIAGRAM OF FLOWER.

transverse section of ovary.

Verbenaceæ.

seeds & placenta.

DIAGRAM OF FLOWER

anther

filament

stamen

corolla

pistil

calyx

flower

capsule
dehisang transversely

Plantaginaceæ.

Fruit of Beet.

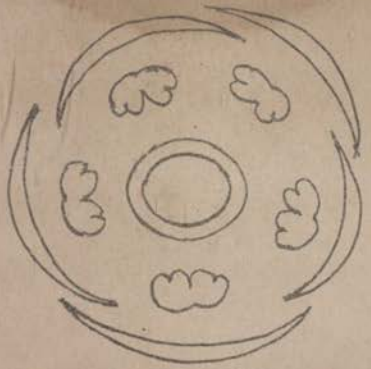
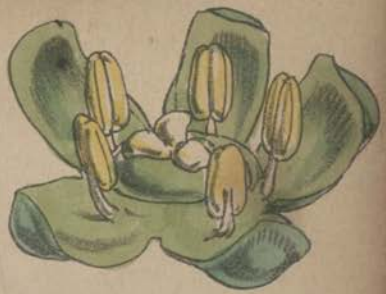


DIAGRAM OF FLOWER.



Flower of Beet.

fruit.

seed.

Chenopodiaceæ.

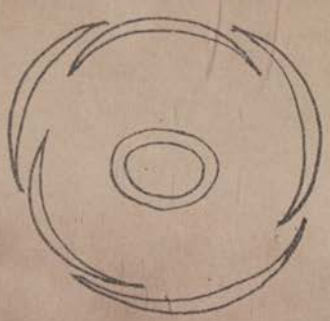


DIAGRAM OF FLOWER

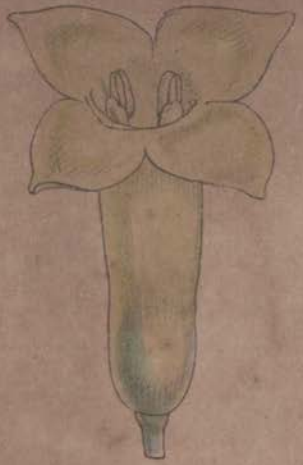
staminate flower.

Pistillate flower.

Amarantaceæ.

DIAGRAM OF FLOWER.

Polygonaceæ.



flower.

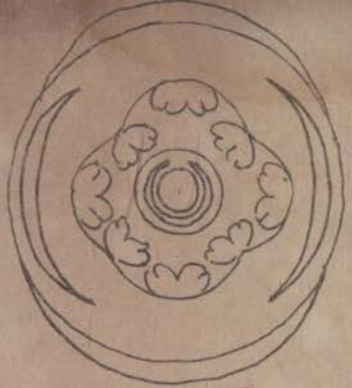
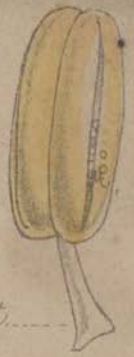
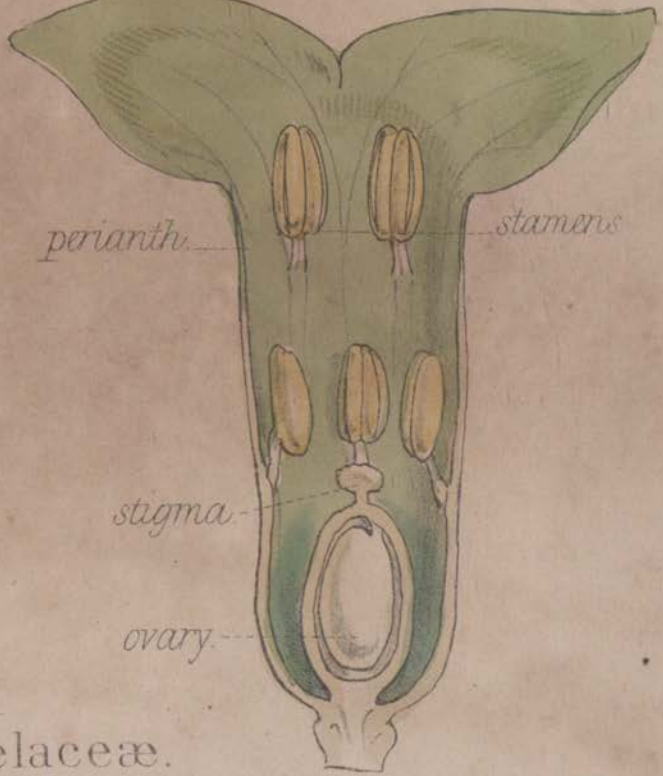
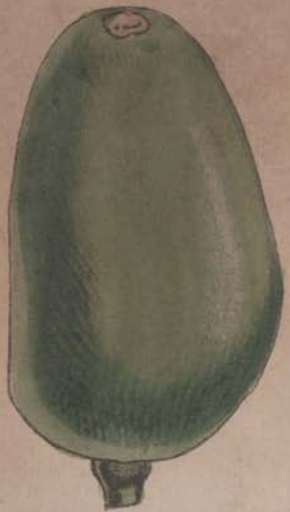


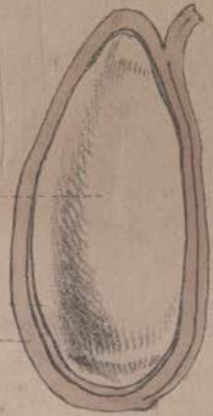
DIAGRAM OF FLOWER.





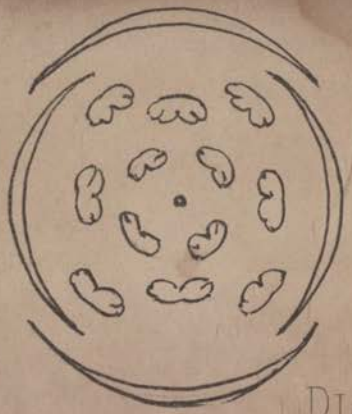


berry.



seed.

Thymelaceæ.



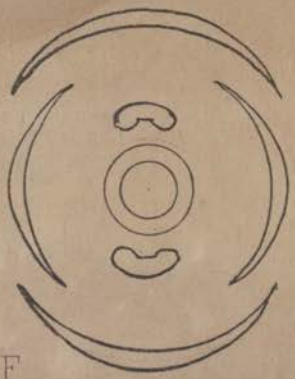
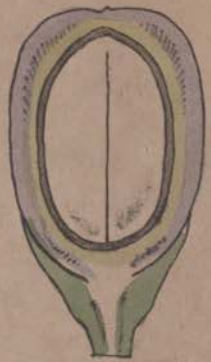


DIAGRAM OF

STAMINATE FLOWER PISTILLATE FLOWER.

pistillate flower.



fruit.

staminate flower.

Lauraceæ.

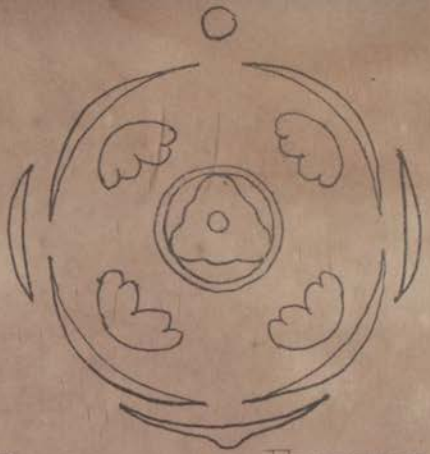
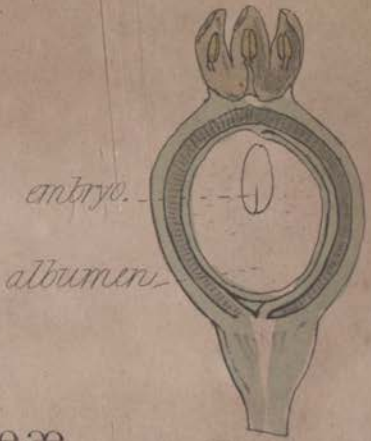


DIAGRAM OF FLOWER.

flower.

Root shewing parasitical attachment



Fruit

Santalaceæ.

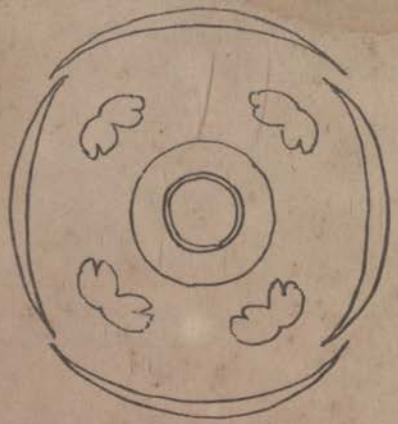
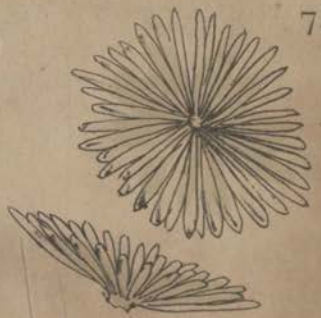
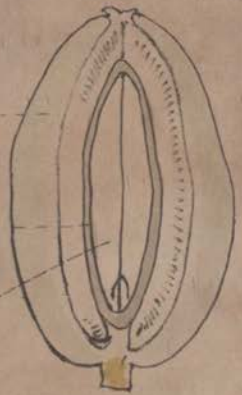


DIAGRAM OF FLOWER.



Peltate hairs of epidermis

Flower



Fruit

Elæagnaceæ.

flower of Asarabacca.

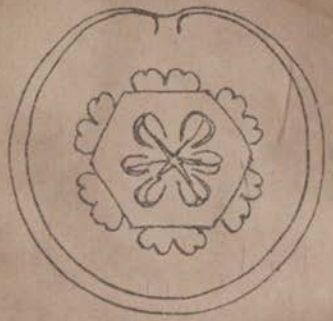


DIAGRAM OF FLOWER.

flower

Aristolochiaceæ

Staminate flower of Mercury.

DIAGRAM OF FLOWERS.

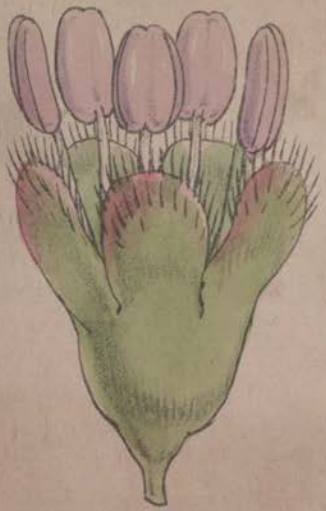
Fruit of Mercury.

Pistillate flower of Mercury.

Euphorbia.

seed of Mercury

Euphorbiaceæ.

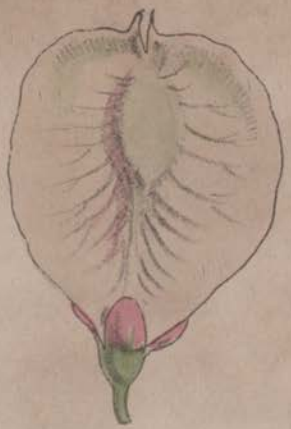


flower.

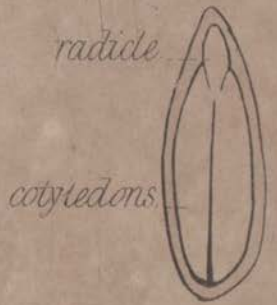
DIAGRAM OF FLOWER.

seed_ side view.

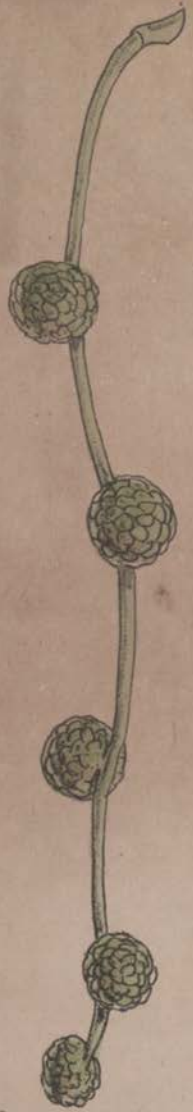
Ulmaceæ.



winged fruit.



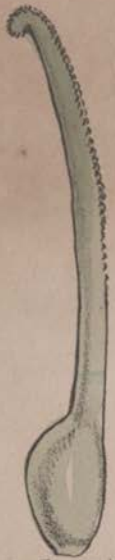
vertical section of seed.



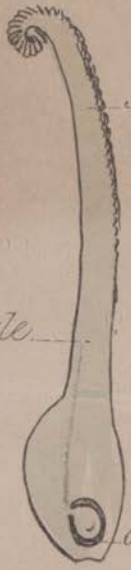
Catkin with staminate flowers.

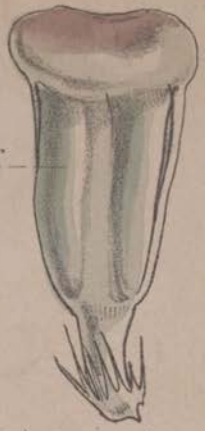
Fruit.

vertical section of Fruit.



female pistillate flower





staminate flower.

Catkin with pistillate flowers

Platanaceæ.

staminate flower.

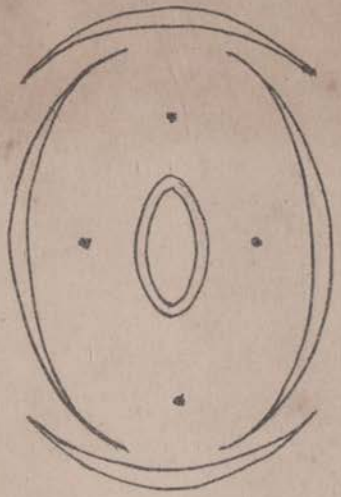
anther.

filament.

DIAGRAM OF STAMINATE FLOWER.

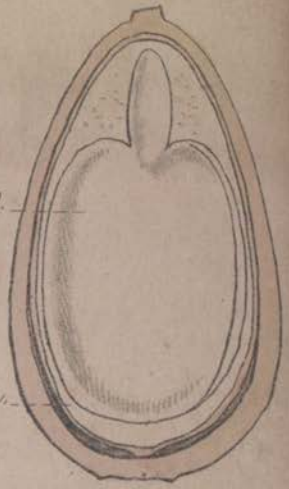
pistillate flower.

Urticaceæ



embryo.

albumen.



seed.

DIAGRAM OF PISTILLATE FLOWER.

staminate flower.

pistillate flower.

pistillate flower.

staminate flower.

fruit catkin with accrescent bracts.

pistillate inflorescence.

embryo

seed.

fibres of Hemp.

bract.

embryo

fruit.

seed.

Cannabinaceæ.

staminate flower of Fig.

STAMINATE FLOWER. OF MULBERRY.

pistillate flower of Fig.

staminate flowers.

pistillate flowers.

receptacle.

Fig fruit.

Moraceæ.

perianth.

PISTILLATE FLOWER.

stigma.

embryo.

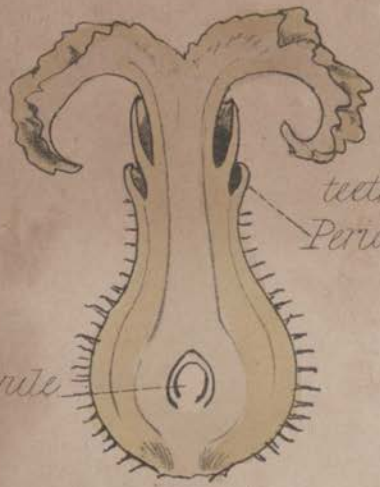
ovary.

Catkin of Staminate flowers.

Endocarp.

Pistillate inflorescence.

anther.



teeth of Perianth.

ovule.

Pistillate flower.

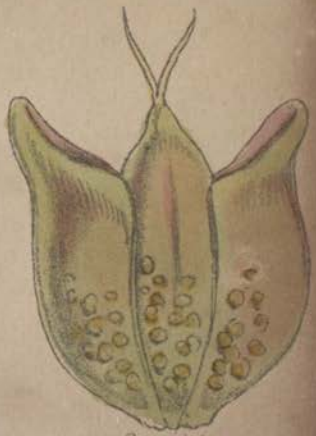
Seed.

transverse section.

Staminate flower.

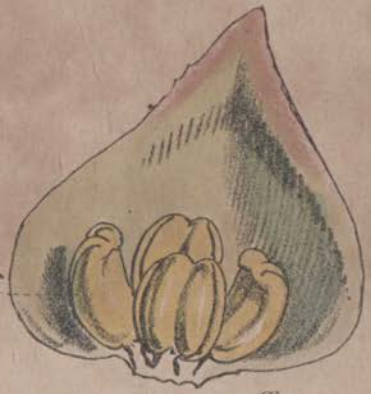
Juglandaceæ.

pistillate flower.

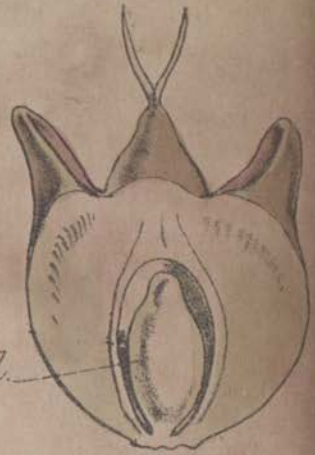


fruit.

pistilliferous catkin.



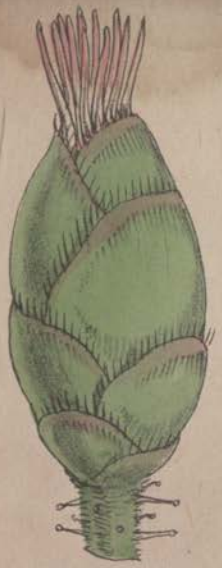
staminate flower.



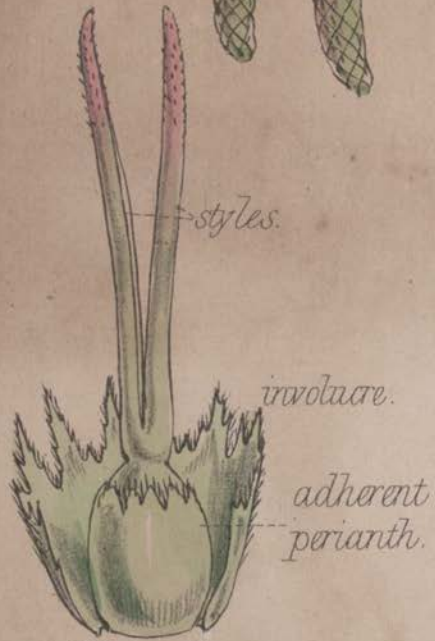
vertical section of fruit.

Myricaceæ.

pistillate flowers.
Inflorescence
staminate flowers.


pistillate flowers.

involucre.
fruit.


styles.
involucre.
adherent perianth.
pistillate flower.

transverse section of ovary.

bract scale
staminate flower.

Cupuliferæ

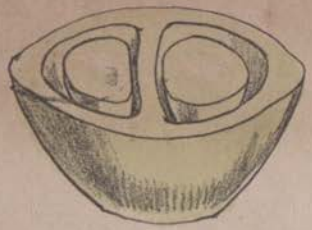
Three pistillate flowers.

staminate

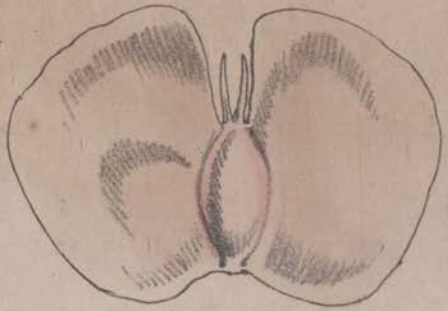
pistillate.

inflorescence.

Three staminate flowers.



transverse section of ovary.



winged fruit.

fruit catkin of Alder. with persistent scales.

Betulaceæ.

pistillate catkin.

coma.

seed.

staminate flower.

staminate catkins.

gland.

pistillate flower.

cotyledons.

radicle.

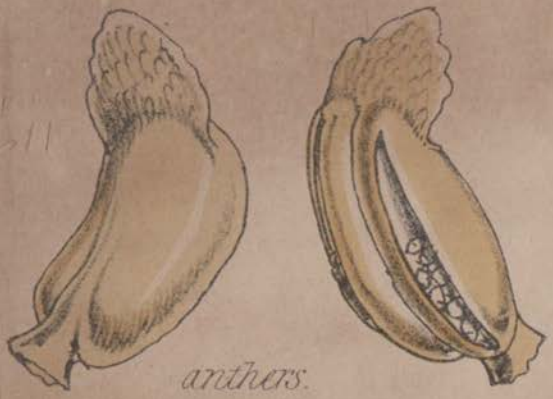
embryo.

Salicaceæ

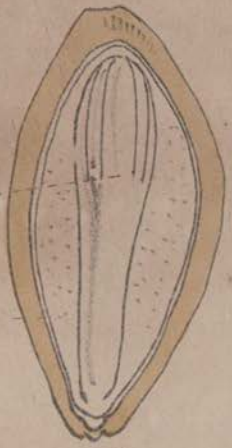
cone.

front

back.



anthers.



seed.

Fruit scale.

Coniferæ.

DIAGRAM OF
STAMINATE FLOWER.

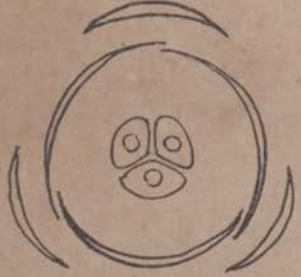
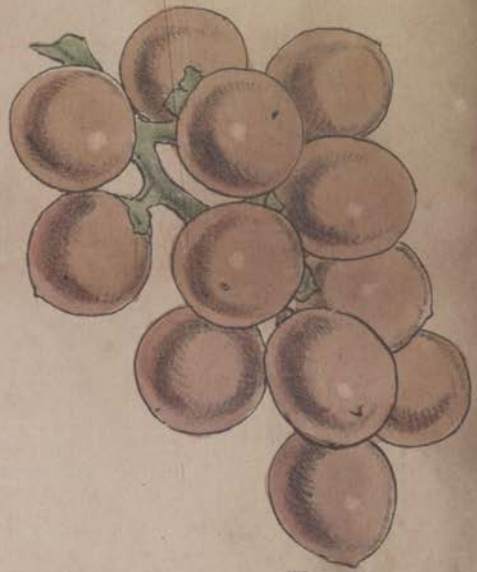


DIAGRAM OF
PISTILLATE FLOWER.

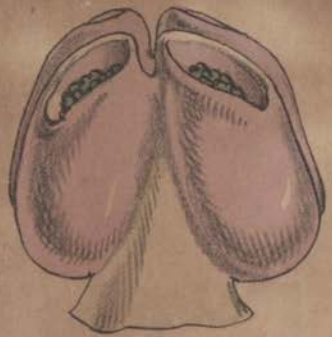
Pistillate flower.

Staminate flower



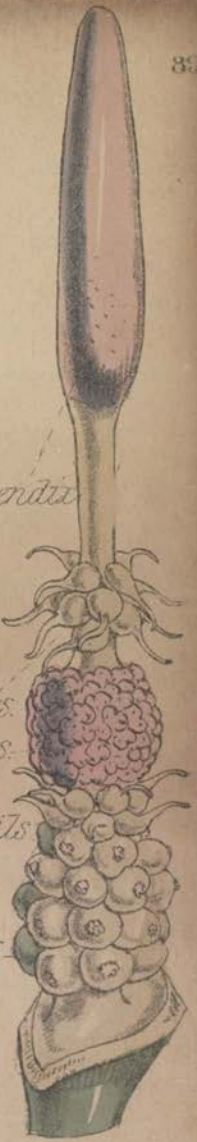
Fruit

Palmaceæ.

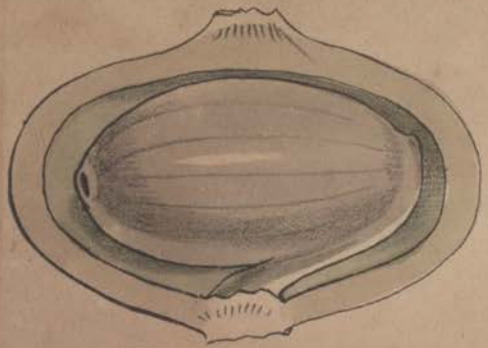


stamen.

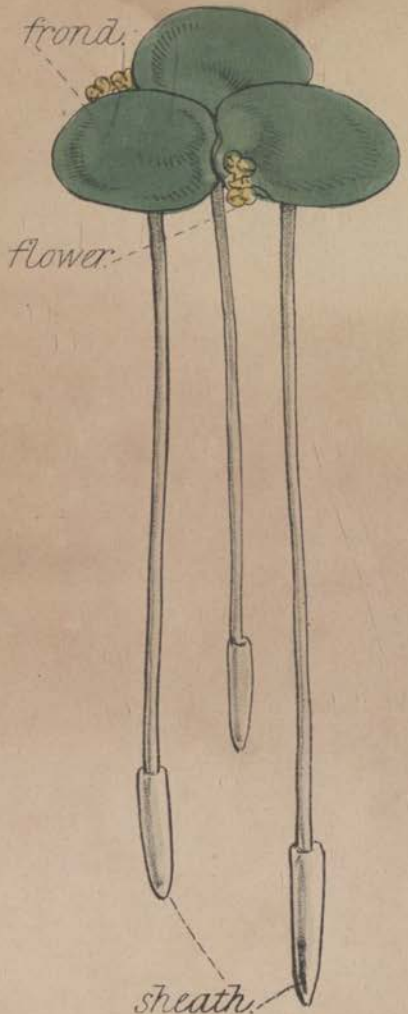
Fruit.



Aroideæ.

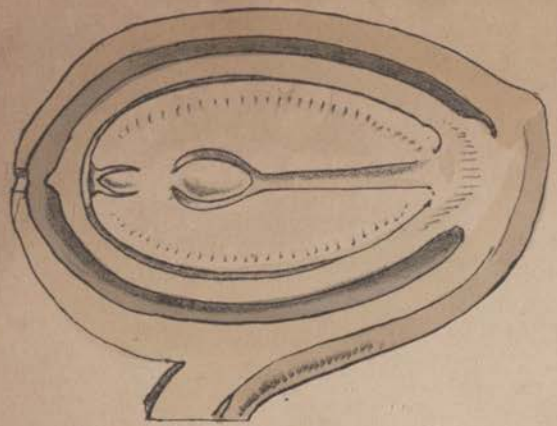


Fruit, cut open.



natural size.

Flower.



Vertical section of seed.

Lemnaceæ.

carpel.

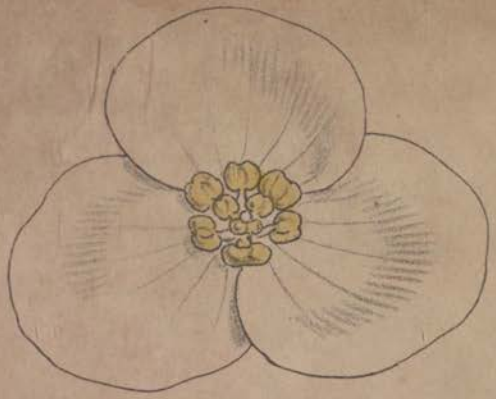
DIAGRAM OF FLOWER.

Fruit.

stamen

embryo.

Alismaceæ.



Staminate flower.

DIAGRAM OF STAMINATE FLOWER.

vertical section of seed.

seed.

Pistillate flower.

DIAGRAM OF PISTILLATE FLOWER

embryo.

Hydrocharidaceæ.

DIAGRAM OF FLOWER.

fruit dehiscang.

Orchidaceæ.

seed.

stigma.

Diagram of Flower.

albumen.

embryo.

seed.

anther.

filament.

stamen.

stigma.

anther.

perianth.

inferior ovary.

fruit dehiscing.

Iridaceæ.

flower

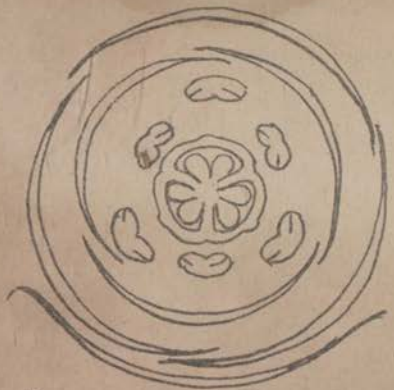
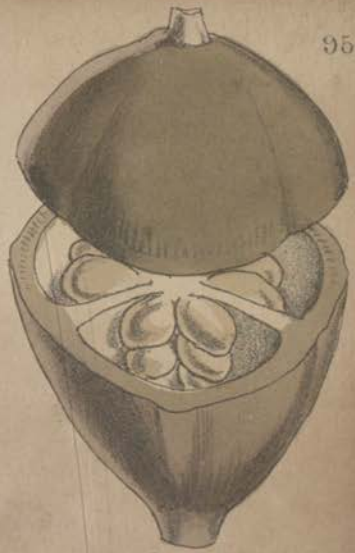
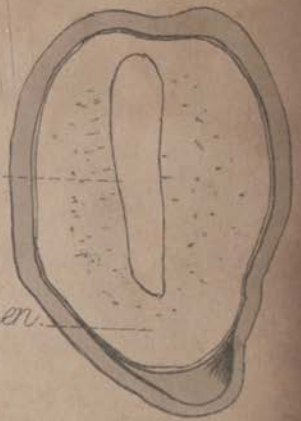


DIAGRAM OF FLOWER.

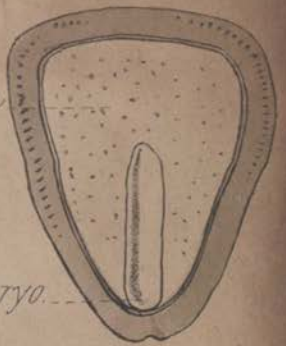

fruit.

bulb



Amaryllidaceæ.

DIAGRAM OF FLOWER.



Liliaceæ.

Diagram of Staminate Flower.

Diagram of Pistillate Flower.

Staminate flower

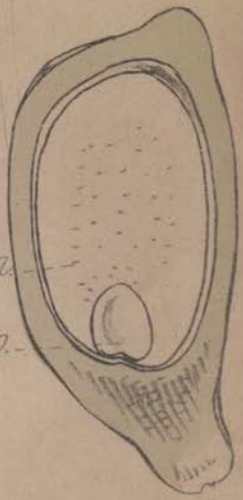
Smilaceæ.

Pistillate flower

Inflorescence.

DIAGRAM OF FLOWER.

Fruit.



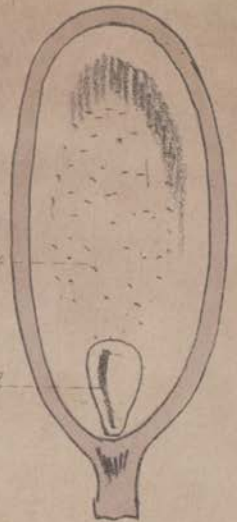
seed.

Juncaceæ.

DIAGRAM OF FLOWER.

in flower.

seed.



seed.

in fruit.

Cyperaceæ (Eriophorum.)

DIAGRAM OF PISTILLATE FLOWER.

staminate flower.

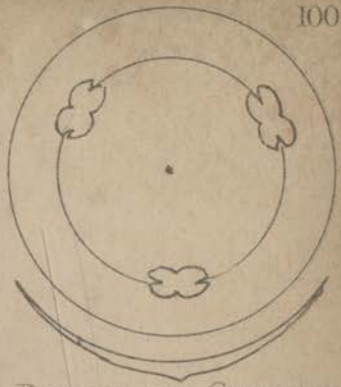


DIAGRAM OF STAMINATE FLOWER.

pistillate flower.

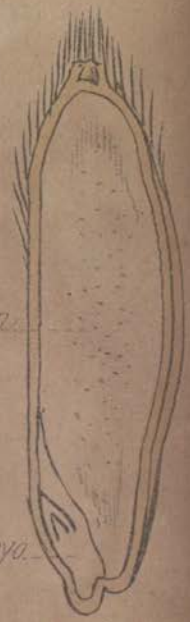
Cyperaceæ *fruit* (Carex)

J.N.Fitch, imp.

grain.

DIAGRAM OF SPIKELET.

Spikelet.



Gramineæ (Avena)

DIAGRAM OF FLOWER.

Gramineæ (Triticum)

Nephrodium.

Pteris.

Adiantum.

Polypodium.

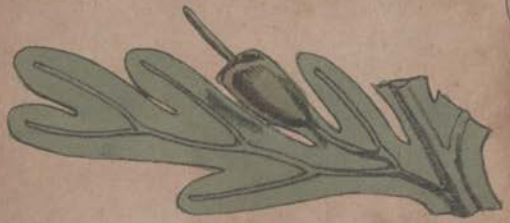
Sporange of Trichomanes.

spores.

Sporange of Nephrodium.

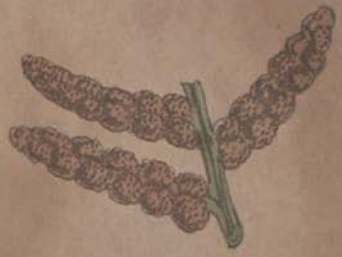
Scolopendrium.

Hymenophyllum.



Trichomanes.

Prothallus.

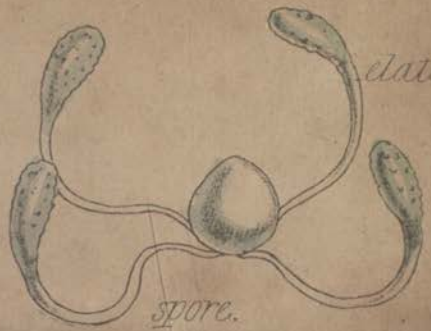


Osmunda.

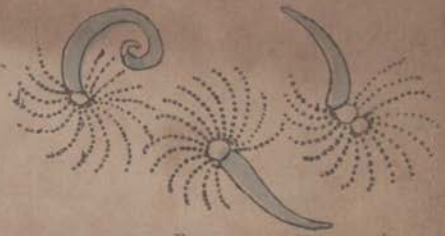
Filices.

Barren frond.

Fertile frond.



scale of cathin with sporanges.



antherozoids

Equisetaceæ.

Microsporange of Selaginella

Selaginella.

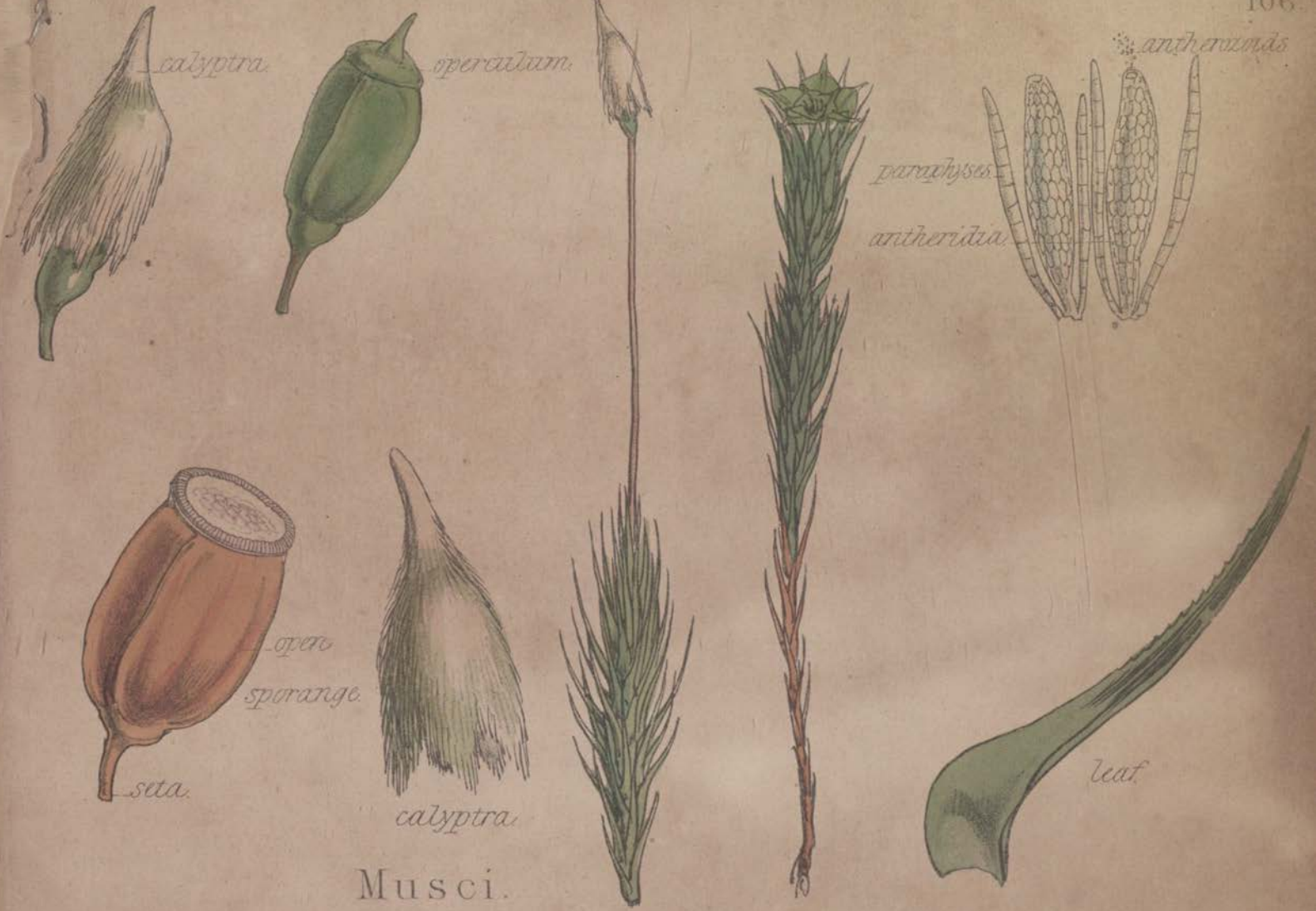
Macrosporange of Selaginella.

Lycopodium clavatum.

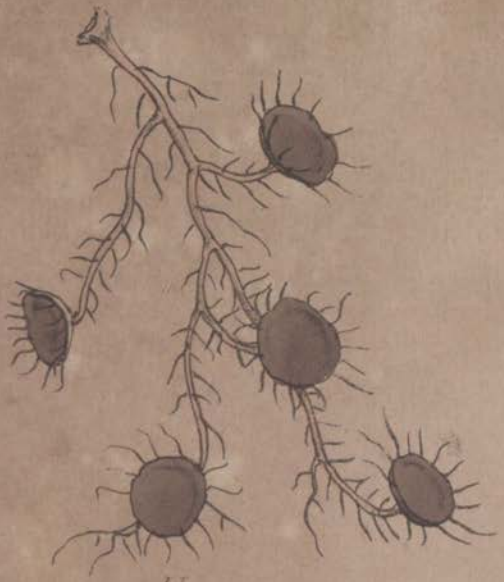
Scale & Microsporange of Lycopodium

sporidia

Lycopodiaceæ.

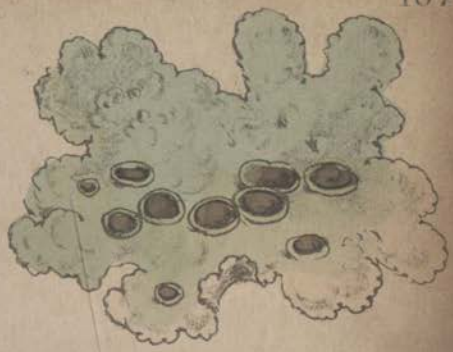

calyptra
operculum
anthaxonids
paraphyses
antheridia
oper.
sporange
seta
calyptra
leaf

Musci.



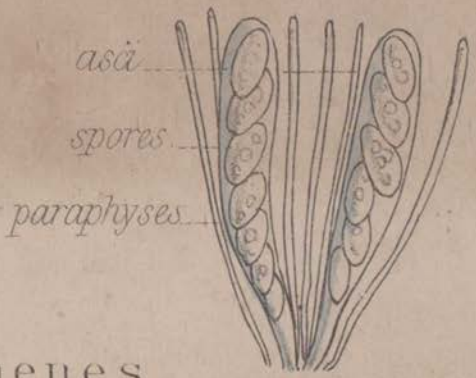
Usnea.

Cetraria.



Parmelia.

open apothecium.



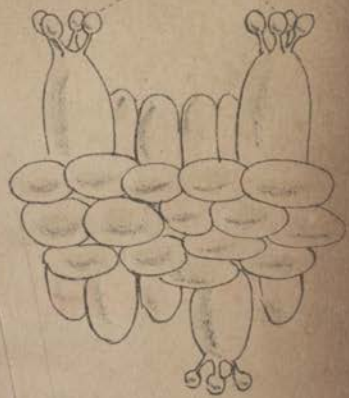
Lichenes.

Thallogen

closed apothecium.

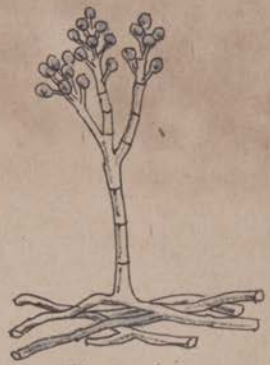
Truffle

Mushroom



Basidia.

Penicillium



Botrytis.

Cyathus.

Fungi.

Thallogen

conceptacle

zoospore escaping

Vaucheria

Conferva.

air vesicle

Fucus.

conceptacle with sporangia and antheridia

Antheridia and antherozoids

Algæ.

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